GEOGRAPHY WESTERN COAL FIELD

WILBUR GREELEY BURROUGHS

The

Kentucky Geological Survey

WILLARD ROUSE JILLSON
DIRECTOR and STATE GEOLOGIST

COMMONWEALTH OF KENTUCKY

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Geography of the Western Coal Field

1924

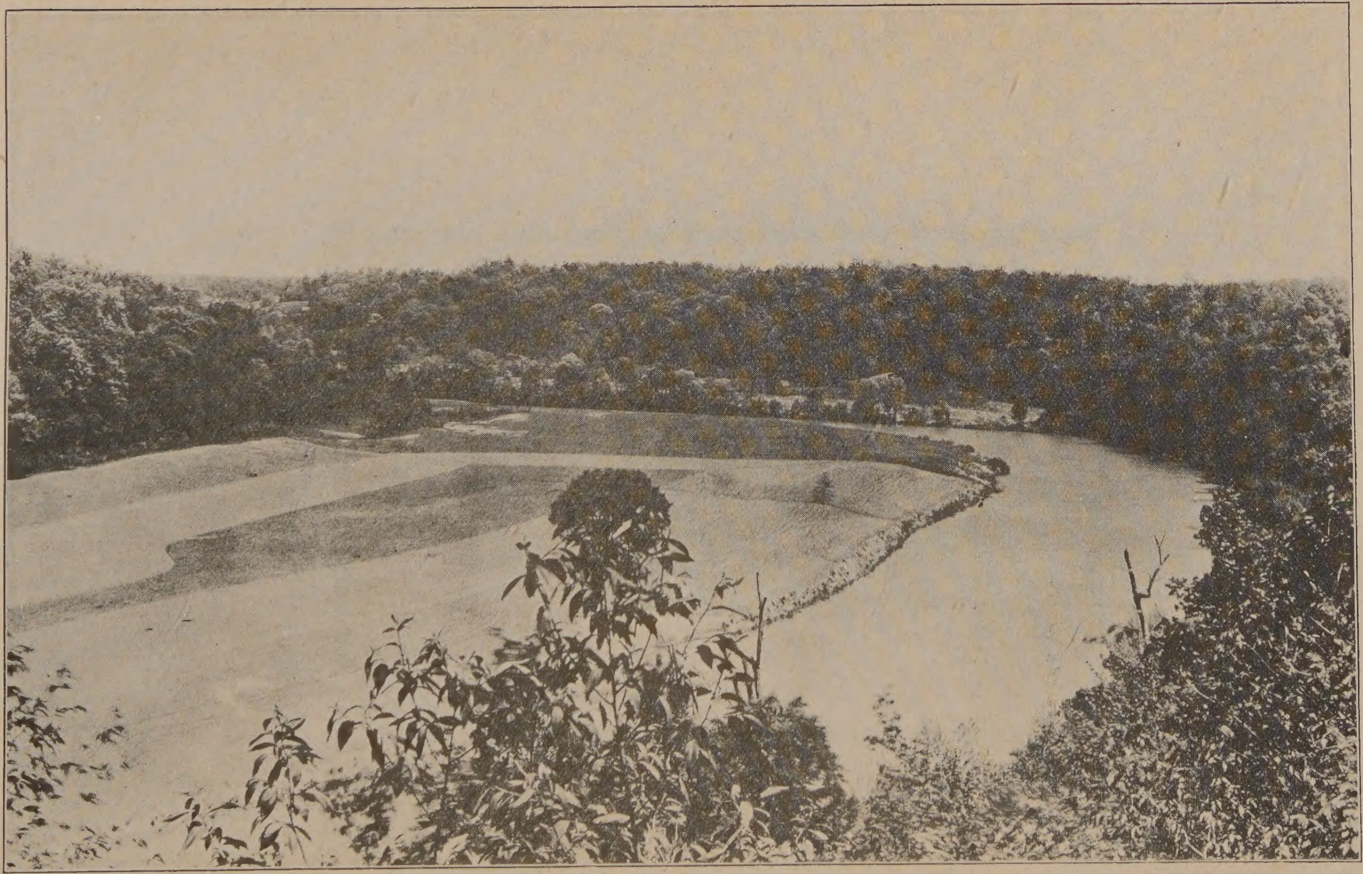

PHOTO BY W. R. JILLSON

ALONG THE GREEN RIVER

This beautiful stream threads its way with many a graceful meander northwesterly across the entire Western Coal Field. Rich farm lands, important coal mines, and extensive rock asphalt fields are found along its course and those of its major tributaries. Being locked it is an important carrier of much heavy freight.

The
GEOGRAPHY *of the* WESTERN KENTUCKY COAL FIELD

A Study of the Influence of Geology and Physiography upon
the Industry, Commerce and Life of the People.

BY

WILBUR GREELEY BURROUGHS

ASSISTANT GEOLOGIST

Illustrated with Seventy-two Photographs,
Maps and Diagrams

FIRST EDITION
500 COPIES

THE KENTUCKY GEOLOGICAL SURVEY
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1924

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To

My advisor and companion
Mavis Reynolds Burroughs
This Book is
Dedicated.

137263

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Letter of Transmission

DR. WILLARD ROUSE JILLSON,
Director and State Geologist,
The Kentucky Geological Survey,
Frankfort, Kentucky.

Dear Sir:

Permit me to transmit herewith my manuscript and illustrations of a report on the Geography of the Western Kentucky Coal Field.

The field work was carried on during the summer of 1923. Photographs, with but few exceptions, were taken by the author.

Throughout this report the author has described the natural resources of the Western Coal Field. The development of these natural resources to the present time and the opportunities that exist for their future growth are discussed. The influence of geology and geography upon the life, industry and commerce has been emphasized.

The Geography of the Western Coal Field has been written so that it can be of value to all those interested in the economic and social advancement of this physiographic division of the State. It also can be used as a textbook, or for collateral reading in the schools. The youth of the Western Coal Field can thus obtain a knowledge of the opportunities afforded them in their own home region.

The author acknowledges the helpful co-operation of Frank H. Leslie, County Farm Agent, Madisonville, Hopkins County; D. W. Gatlin, Secretary of the Chamber of Commerce, Madisonville; M. E. Hicks, Assistant Secretary of the Chamber of Commerce, Henderson; R. H. Ford, Drainage Commissioner, Owensboro, Daviess County; John E. McClure, County Farm Agent, Owensboro. Credit is given throughout the report for assistance rendered by various other citizens of the State. Special acknowledgement is due Dr. W. R. Jillson, Director and State Geologist of the Kentucky Geological Survey for his helpful cooperation. Mrs. Mavis Reynolds Burroughs gave valuable aid in the preparation of the manuscript.

It is the author's sincere desire that this bulletin may be of service in many ways to the people of the Western Coal Field and to the State.

Respectfully submitted,

WILBUR GREELEY BURROUGHS,
Assistant Geologist.

Berea, Kentucky,
Nov. 30, 1923.

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The GEOGRAPHY *of the* WESTERN KENTUCKY COAL FIELD

CHAPTER I

GEOGRAPHIC CONDITIONS

Physiographic Divisions of Kentucky

Kentucky is naturally divided into six physiographic regions which are as follows:

1. The Bluegrass.
2. The Knobs.
3. The Eastern Kentucky Mountains.
4. The Mississippian Plateau.
5. The Western Kentucky Coal Field.
6. The Jackson Purchase.

THE WESTERN KENTUCKY COAL FIELD

Space Relationship

The Western Kentucky Coal Field forms the southeastern portion of the great Eastern Interior Coal Field which includes parts of Indiana and Illinois. In Kentucky the main mass of the coal field extends approximately from North Latitude 37 degrees to 38 degrees, and from West Longitude 86 degrees 30 minutes to slightly west of 88 degrees.

Measured in miles, the greatest distance between opposite sides of the Western Coal Field is approximately 62 miles from north to south, and 103 miles from east to west. The boundaries are irregular. however, and the distances between the opposite margins vary somewhat from these extremes. On the eastern side, a narrow projection of Pottsville strata extends out from the coal field proper for a distance of forty miles.

The Western Coal Field is bounded on the north, northwest, and a portion of the western border by the Ohio River which separates Kentucky from the States of Indiana and Illinois. The remaining boundaries of the Western Coal Field are formed by the margins of the Pennsylvanian strata which adjoin the Mississippian Plateau.

In area the Western Coal Field covers 4,680 square miles which is 11.6 per cent of the total area of the State of Kentucky. The Pennsylvanian strata of this coal field are found to a marked extent in twenty-one counties. The marginal counties which contain small areas of Pennsylvanian formations are Breckinridge, Hart, Warren, Logan, Todd, Christian, Caldwell, Crittenden and Livingston. Larue, Green, Taylor, and Marion counties have only a very narrow strip of Pottsville which forms the eastward extension of the projection of Pennsylvanian strata already referred to. Butler, Edmonson, and Grayson are border counties but they embrace such large areas of Pennsylvanian strata that in this report they are included in the Western Coal Field proper. Counties practically entirely within the coal field are Daviess, Hancock, Henderson, Hopkins, McLean, Muhlenberg, Ohio, Union and Webster. Of these counties, Hancock, Daviess, Henderson and Union have recent deposits covering the Pennsylvanian formations along the Ohio River margins. The Coal Measures, however, dip beneath these recent deposits and continue under the Ohio River into Indiana and Illinois. Pliocene and Pleistocene deposits are found along some of the river valleys throughout the Coal Field.

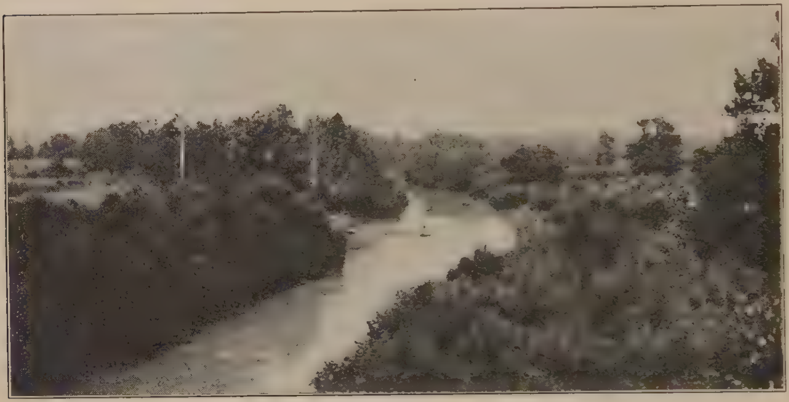

PLATE I. FERRYBOAT CROSSING THE TRADEWATER RIVER.
Crittenden County is seen on the left, Webster County to the right.

Several rivers have helped the people of the Western Coal Field, especially during its early development, to keep in touch with the outside world. Along these streams and their tributaries Indians, explorers and settlers made their way. As the region became settled and industries grew up, the waterways served as highways of commerce. These streams are the Ohio River already mentioned, the Green River which practically bisects the coal field as it flows in a general northwesterly direction to empty into the Ohio, and the Tradewater River, Plate I, a smaller stream, which flows northwestward along the major part of the western margin of the coal field and also empties into the Ohio River.

Railroads serve a large area of the Western Coal Field. Butler, however, has no railroads, and a number of towns in the other counties are reached only by steamboat, wagon, or automobile. Railroads operating in the coal field are the Illinois Central, Louisville and Nashville, Louisville, Henderson, and St. Louis, and the Kentucky Midland. The Mammoth Cave Railroad is in Edmonson County just outside of the coal field proper. These railroads bring the Western Coal Field into close touch with Louisville and other important commercial centers of the United States.

PHYSIOGRAPHY.

The general surface of the Western Coal Field consists of gently rolling to hilly uplands dissected by streams. Along many of these streams, after one leaves the rougher land and narrower valleys of the eastern and southern perifery, occur wide, flat bottom lands, poorly drained and often swampy. Adjacent to the Ohio River occurs a broad, level strip of bottom land. Near the Ohio River this land in places is wet and swampy. Elsewhere it is cultivated. The bottom lands stretch away from the river until they meet the uplands which rise suddenly above the plain, occasionally forming bluffs.

The eastern and southern margin of the Western Coal Field is a plateau thoroughly dissected by erosion. The tops of the divides are rolling to hilly, Plate II, their sides falling away rapidly to the bottom of the adjacent narrow V-shaped valleys. Some of the ridges are comparatively broad and level, but the majority are narrow and irregular. The elevations of the tops of some of the hills in Grayson County near Millwood are 760 to 860 feet with the valleys 500 feet above sea-level. In Edmonson County the crests of the divides a few miles north of Brownsville vary from around 600 feet to 786 feet above sea-level. The valley bottoms are from 100 feet to 200 feet below the hilltops. Dividing Ridge of Butler County has an elevation of 640 feet at the crest and 420 feet at the base of the slope along Reedy Creek a few miles north of Green River. The elevation of the ridges near where Todd, Logan and Muhlenberg counties meet is 648 feet to 663 feet, and the valleys 420 feet above sea-level. Along the border of Caldwell and Hopkins counties the tops of the hills are about 540 feet and the valley of the Tradewater River 380 feet above sea-level. The land drains toward the Ohio River.

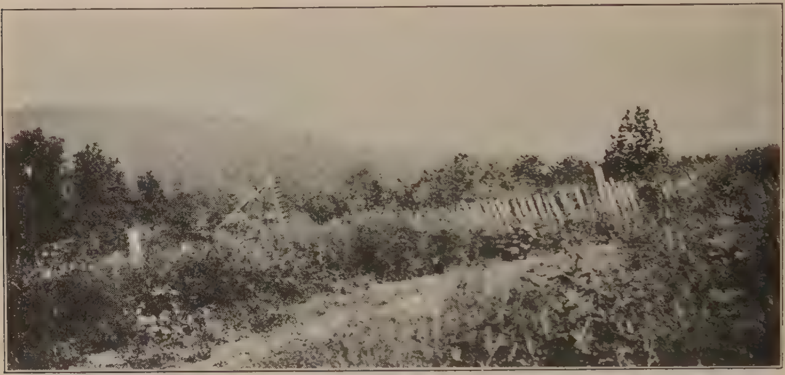

PLATE II. THE WOODED HILLS OF NORTHERN CHRISTIAN COUNTY.

Away from the rough surfaced border toward the interior of the Western Coal Field, the valleys of the main streams increase in width, and the hills in general are not as rugged as near the perifery, although the higher uplands are greatly dissected. Near Hartford, Ohio County, the tilltops are 600 feet and their base along Rough River 400 feet above sea-level. Northeast of Madisonville the hills slope from an elevation of 440 feet and 500 feet down to 400 feet in the valley bottoms of Pond River which here in places are over three miles in width, Plate III.

The flat bottom lands bordering the streams are found throughout the uplands away from the eastern and southern margins. The valleys have been partially filled during former periods of ponding and accompanying sedimentation, and by wash of rock fragments and soil from the higher lands. The upper slopes of the hills emerge from the aggraded valley bottoms. Drainage is poor in these flat valley bottoms and swampy conditions occur.

Large areas of the Western Coal Field are gently undulating as one goes toward the Ohio River, but in places the more resistant rock formations cause a more hilly topography. In Union County northwest of Morganfield the tops of the hills are 400 to 420 feet and the adjacent valleys 380 feet above sea-level, giving a beautiful rolling land.

PLATE III. THE BOTTOM LANDS OF POND RIVER, HOPKINS COUNTY.

The uplands meet the Ohio River bottoms in a distinct and often steep slope forming a sharp dividing line between these two physiographic divisions. A range of hills has been cut parallel to the Ohio River bottoms where the streams have eroded narrower, deeper valleys as they prepare to leave the uplands for the Ohio River plain. At Hawesville, Hancock County, the uplands extend nearly to the Ohio River where they drop from an elevation of 540 feet to 400 feet within a short horizontal distance. Near the mouth of Green River, Henderson County, the upland has an elevation of 500 feet from which it slopes down to 380 feet at the Ohio River bottoms. The elevation of the hilltops near the mouth of the Tradewater River in Union and Crittenden counties is 520 feet and the valley bottoms 340 to 360 feet.

The Ohio River bottoms form a plain along the margins of Hancock. Daviess, Henderson and Union counties. These bottoms vary in width from less than one-fourth mile in Hancock

County to 7½ miles where the Green River flows past Bluff City to empty into the Ohio River nearby. A yet broader area of Ohio River bottoms is found where the Ohio River bends sharply southward near the boundary of Henderson and Union counties. Throughout much of their length the Ohio River bottoms are 20 feet and slightly over above the normal water level. During time of flood they are inundated, and deposition occurring in greater amount near the river channel has formed, in places, ridges near the banks of the main stream. From these natural levees the land slopes gradually inland. Sloughs and marshy land occur in long narrow stretches along the flood plain, sometimes extending parallel to the Ohio River into which they cannot empty because of the higher land near the river's edge. Sometimes these sloughs empty into creeks and rivers. Occasionally they reach the Ohio River direct. In some places a terrace rises above the flat surface of the flood plain forming a "second bottom" land.

Outside of the Western Coal Field proper normal faulting of the strata has brought blocks of Pottsville down into the Mississippian formations of Caldwell, Crittenden and Livingston counties, as shown on the Geologic Map of Kentucky, 1923 edition. A down-faulted block of Pottsville with an average width of one and one-half miles, is found in Livingston County extending from the Ohio River just west of Carrsville southwestward for about 10 miles. Due to the resistance to weathering of the Pottsville strata, this faulted block at present rises in a bluff higher than the surrounding areas of Mississippian age. The down-faulted masses of Pottsville give rise to hills of more than usual height for that region. Pennsylvanian strata which have been brought down into the Mississippian by normal faults project out from the edge of the main body of the Western Coal Field especially in Caldwell County.

The Western Coal Field is drained by the Ohio, Green and Tradewater Rivers and their tributaries. The Ohio River flows along the border of Hancock, Daviess, Henderson and Union counties. Many of the smaller streams in these counties that are near the Ohio flow directly into that river.

The Green River through its tributaries drains a part of the Pottsville projection which extends from Hart County along the border of Green, Larue, Taylor and Marion counties. Rolling Fork of Salt River drains the northern side of this tongue of Pottsville. The Nolin River, flowing southwestward, cuts through the Pennsylvanian strata in Edmonson County and empties into Green River northeast of Brownsville. The Green River touches the coal field along the southwestern edge of Edmonson County, turns to the northwest in Butler County where it is joined by the Big Barren River from the south, and continues northwestward in a meandering course, Plate IV, until it finally empties into the Ohio River northwest of Basket, Henderson County. While bisecting the coal field Green River is reinforced at Livermore, McClean County, by Rough River flowing from the northeast. A short distance upstream from Ashbyburg, McClean County, Pond River flowing northward, unites with Green River. Near Curdsville, Daviess County, Panther Creek flows westward into Green River.

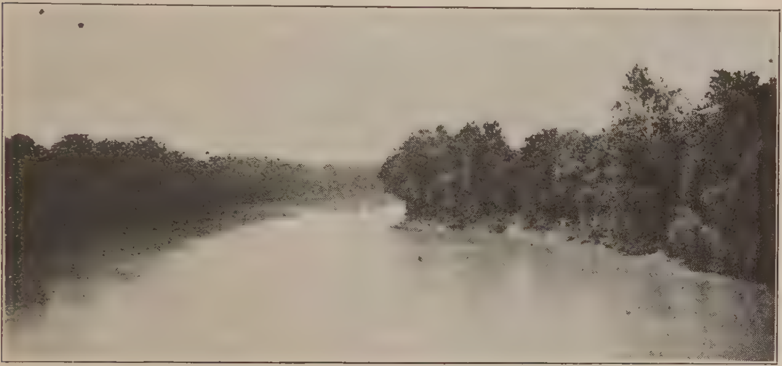

PLATE IV. THE GREEN RIVER.
View down stream. In the scene here shown, the river forms the boundary between Ohio and Muhlenberg counties.

The Tradewater River flows northwestward continuing near the western edge of the coal field for the greater part of the distance that it traverses Pennsylvanian strata. It empties into the Ohio River at the boundary of Union and Crittenden counties. A narrow divide running northwest-southeast separates the Tradewater River from Green River. Tributaries to both streams are cutting headwards into this divide. The Tradewater empties into the Ohio River many miles downstream from the mouth of Green River, and being at a lower level the Tradewater's tributaries have worked their headwaters farther back into the divide than have the tributaries of Green River. Hence the divide is nearer Green River than it is to the Tradewater River. (Ref. 33:11). The smaller streams of the uplands and the aggradation that is taking place along their valleys have already been described.

CHAPTER II

GEOLOGY.

The Western Kentucky Coal Field is made up nearly entirely of strata of Pennsylvanian age. Deposits of Pliocene, Pleistocene and Recent times are found along stream valleys and as loess distributed over wide areas by the wind. In a few river valleys the younger formations have been cut through exposing the higher Mississippian formations. The Coal Field is bounded by Mississippian strata except along the margin where the Ohio River flows. Beneath the rocks which outcrop occur strata of the lower Mississippian, and the Devonian, Silurian and Ordovician which under favorable geologic conditions may contain oil and gas.

GEOLOGIC HISTORY.

The geologic history of the Western Coal Field is connected so closely with that of Kentucky as a whole that a brief account of the general geology of the State must be given in order to understand the structure of the Western Coal Field.

Beginning at the close of Oswegan times of the Silurian period, the strata were folded into a low anticline which caused the rock formations to emerge from the sea which had covered Kentucky (Ref. 58:54). Due to this and subsequent movements, a fold called the Cincinnati Arch or Anticline was developed with its axis extending from the State of Ohio across the Ohio River at Point Pleasant, about twenty miles upstream from Cincinnati. Continuing southward the axis passes near Lexington, domes upward to its highest point in what is called the Jessamine Dome in the county of that name, and from there pitches southwest, passing through the eastern part of Monroe County into Tennessee. Near the Kentucky-Tennessee boundary the Arch bows up into the Rutherford Dome of Tennessee. On either side of the Cincinnati Arch the strata dip to the east and west. During the ages which have elapsed since the Cincinnati Anticline was formed, it has been eroded and submerged several times. The higher portions of the Arch have each time been worn away more rapidly than the areas lying in the synclines on either side of the geanticline.

At the close of the Mississippian the sea withdrew from a large part of the eastern interior of the United States, thereby exposing the sediments which formed dry land to the agents of erosion. The Mississippian strata in the higher portions of the Cincinnati Arch were worn away more rapidly. This beveling of the strata caused the various formations to outcrop in belts about the higher portions of the Arch. Deep channels were worn in the Mississippian rocks. In some localities softer shales and limestones overlying the Mammoth Cave limestone were entirely eroded away and the Mammoth Cave limestone itself, cut into.

When the Pennsylvanian period commenced, waters advanced slowly westward from a region to the east of Kentucky. Near the crest of the Arch especially, they encountered a much eroded land surface dissected by river valleys. Upon this uneven surface as well as in the synclinal portions were laid down the basal rocks of the Pottsville formation of the Pennsylvanian system. In the territory higher up on the Cincinnati Anticline, the deposits were deepest where they filled the Mississippian river valleys. With the continuance of the Pennsylvanian period extensive swampy areas came into existence and coal began to be formed. At the close of the Pennsylvanian, Kentucky was elevated never again to be completely covered by the sea.

During the ages that have elapsed since the close of the Pennsylvanian extensive erosion has taken place especially along the higher portions of the Cincinnati Arch where the Ordivician strata have been uncovered forming the Bluegrass division of Kentucky. The Knobs form a fringing margin between the main masses of the Pennsylvanian and Mississippian formations, and the Bluegrass. The present Eastern and Western Kentucky Coal Fields owe their existence to being down on the flanks of the Cincinnati Anticline where they have not been eroded so rapidly as have the formations nearer the axis of the Arch.

The Eastern and Western Coal Fields of Kentucky, and hence the Appalachian and Eastern Interior Coal Fields of which they form parts, respectively, were once connected at least in certain portions of Kentucky. A remnant of the strata which formerly was continuous between the Eastern and Western Coal Fields can be seen at the present day as shown in Fig. I. It originally was a channel in the Mississippian formations, filled with Pottsville pebbles and sand. Down-faulting of parts of this channel and the more rapid erosion of the formations on either side of the main valley have resulted in leaving this strip of Pennsylvanian sediment bordered by Mississippian strata. It projects as a narrow tongue of Pottsvile conglomerate, eastward from the Western Coal Field across Hart, and along the boundaries of Green, Taylor, and Marion counties. Even after its continuity disappears, patches of pebbles occur here and there eastward across Lincoln County to the Eastern Coal Field.*

Outliners of Pennsylvanian strata, some of which contain coal seams, were downfaulted in Livingston, Crittenden and Caldwell counties.

Toward the latter part of Tertiary times a peneplain was formed. Ridges of hard Pottsville conglomerate remained in places along the perifery. The general slope of this plain was probably westward and northwestward (Ref. 33 :31, 32) in Webster and adjacent counties. This territory was doubtless drained by the Green and Tradewater Rivers which probably flowed somewhere near their present channels although at 250 to 300 feet higher elevation. Following the formation of this peneplain, the land was uplifted in late Tertiary time. Erosion ensued, followed by renewed uplift. The rejuvenated streams transported sand, quartz and chert pebbles and deposited them in their valleys. Another order of geologic events during which this river gravel was deposited is given by L. C. Glenn in his report on the Geology of Webster County, page 32. Remnants of the gravel deposits still occur. In places the gravel has been cemented together by iron compound into a limonitic conglomerate. In age it probably belongs to the Lafayette formation of the Pliocene.

Additional uplifting of the Western Coal Field ensued. "It is very probable," states L. C. Glenn (Ref. 33:33), "that this uplift permitted the streams to cut down to a level only slightly—perhaps 10 to 30 feet—below the level of the present lowland surface and that there was then a pause while the valleys were widened to approximately the condition in which they are found today, after which a further uplift allowed the main stream to sink a narrow gorge or valley within the broad one that had just been formed. In numerous sections across the Tradewater valley rock in place is found at such short intervals that it would seem impossible that there could have ever been an old broad valley there cut very far below the present floodplain level. Borings, however, show alluvial filling 175 feet thick near Sturgis and about 100 feet thick even up at Dawson Springs. The same is true of Green River valley.'' These uplifts, down-cuttings and valley widenings occurred in early or middle Pleistocene time. Later in the Pleistocene the land sank and the streams began to fill up the valleys they had just excavated, at first with gravel, sand and clay, later with a fine silt dropped partially, at least, during ponding of the Tradewater and Green Rivers and their tributaries. These deposits are 100 to 175 feet deep in the valleys of the Green and Tradewater Rivers (Ref. 33:34). They have formed in great part, the broad, level valley bottoms of today.

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*Burroughs, W. G.; "A Pottsville-Filled Channel in the Mississippian," Kentucky Geological Survey, Series VI, volume 10, pages 115 to 126.

The next deposit to be laid down was a loess. It originally was a rock flour ground from the solid bedrock of more northern latitudes by the great ice sheet of Pleistocene times. Southward flowing streams transported this finely pulverized rock to Kentucky and other States where it was deposited along the flood-plains of streams. Winds picked the dust up and dropped it again as a mantle over portions of the Western Coal Field uplands. The loess varies from six to fifteen or twenty feet thick, the greatest depth being nearer to the Ohio River.

The most recent geologic movement of the strata has been a slight uplift that, according to L. C. Glenn (Ref. 33:34), ''may still be in progress.'' Due to this uplift the larger streams have cut slightly into their valley deposits. Where the valley fillings are of shallow depth, the Tradewater River, at present, is cutting into Pennsylvanian bed-rock.

The flood-plains of the smaller streams of the uplands are being filled up by wash of material from the surrounding hills.

Recent deposits are also being made along the flood-plains of the Ohio River and other streams.

A description of each of the formations of the Western Coal Field, condensed from the excellent report of Professor L. C. Glenn (Ref. 33 : 60-123), is herewith given in ascending geologic order. The geologic column showing the strata which make up the Pennsylvanian systems in the Western Coal Field is given on the geologic map of Webster County, 1922, by L. C. Glenn. This map may be secured from the Kentucky State Geological Survey.

MISSISSIPPIAN SYSTEM.

Mississippian strata are exposed along the stream valleys of the border counties of the Western Coal Field.

LEITCHFIELD FORMATION.

Within the main mass of the Coal Measures, limestones, sandstones and shales, considered to be of Leitchfield age, occasionally are exposed in gullies and excavations along the overthrust side of the Rough Creek anticline. Overlying these formations is the basal Pottsville conglomerate.

PENNSYLVANIAN SYSTEM.

CASEYVILLE FORMATION.

This formation, 200 to 500 feet thick, is made up chiefly of massive cross-bedded sandstone, usually coarse grained. Some-

PLATE V. AMONG THE HILLS OF CENTRAL MUHLENBERG COUNTY.
The valley is being aggraded by material washed from the surrounding hills.

times it is a conglomerate, containing well rounded quartz pebbles. The thickness of the beds varies greatly within short distances. Interbedded with the conglomerate are beds of shale which occur up to thirty feet in thickness. These shale strata contain coal beds that occasionally are thick enough to mine over small areas.

TRADEWATER FORMATION.

This formation, 175 to 700 feet thick, is composed chiefly of shales, the majority of which are arenaceous. They are usually gray, blue or light green, sometimes dark brown or black. Near the lower portion in the Tradewater region they are micaceous and of a dark gray color.

Sandstone forms a minor part of the formation. In the upper portion it is medium to fine-grained and usually thin-bedded. In the lower part two sandstones, each 20 to 50 feet thick, are found in certain places. Over short distances they vary greatly in character and thickness.

Some thin limestones, layers of chert and several coals of local extent are also included in the Tradewater formation. The three lowest of these coals were numbered by Owen as IA, IB, and IC. Other more important coals in the Caseyville-DeKoven region, he numbered 2 to 6 inclusive. Of these coal seams the only ones of economic importance are Owen's IB, also known as the Cook or Bell coal, and his number 5 coal, in this area usually called Coal 6. Above Coal 6 occurs a coal called by Owen No. 6, which now-a-days is usually numbered 7. It is of variable thickness but not of value at present.

CARBONDALE FORMATION.

This formation consists of shales, sandstones, coals and limestones. The basal member is a coarse, massive sandstone called the Sebree sandstone. The order and thickness of these strata and coals are shown in the geologic column on the map of Webster County, 1922, by L. C. Glenn. Total thickness is 230 to 650 feet.

No. 9 Coal is usually 4 feet 8 inches to 4 feet 10 inches thick. It is extremely regular in occurrence and thickness throughout the Western Coal Field where it is of great economic importance.

Coal No. 10, when present, occurs in southern Webster County 30 to 45 feet above Coal No. 9. No. 10 Coal, however, is often missing. Where found, it usually is only one to two feet thick, although it is mined at DeKoven, Union County.

Coal 11, in Webster County, is 80 to 90 feet above Coal 9. Coal 11 is found up to 61 to 73 inches in thickness. It is of great economic importance, but is not uniformly present, being absent because of lack of swampy conditions or because of erosion after it had been laid down.

The roof of Coal 11 is sometimes formed by the Providence limestone which is five to eight feet thick, or a few feet of black shale may come between the coal and the limestone. In other places a soft, gray clay may intervene.

Coal 12 comes above the Providence limestone. The distance of Coal 12 from Coal 11, varies from 4 to 22 feet. Coal 12, when it occurs, varies in thickness from a thin sheet to seven feet and over. Shale occurs in some regions above No. 12 Coal up to the top of the Carbondale formation.

Lisman Formation.

This formation, 900 to 1000 feet thick, is composed principally of soft shales and sandstones, several thin limestones in the lower half, and usually a more massive, coarse sandstone at the base. The massive sandstone is called the Anvil Rock sandstone. From places where it is absent, it varies to 55 feet and more in thickness. A number of coals are scattered throughout the Lisman formation, but they are usually thin and of no economic value. One coal bed, however, known as Coal No. 14 or the Baker Coal, which occurs near the bottom of the Lisman formation, is locally thick and of value.

Dixon Formation.

This formation, 250 to 430 feet thick, includes all of the Pennsylvanian strata above the Lisman formation. The Dixon sandstone is the basal member. It is medium grained and generally varies in thickness from 10 to 30 feet, in places reaching 60 feet. Above in ascending order come the Bald Hill shales, Vanderburg sandstone, Mt. Gilead shales with thin seams of coal, and limestones, and at the top the Mt. Gilead sandstone, 15 to 30 feet thick.

PLIOCENE.

LAFAYETTE FORMATION.

This formation is made up of a deposit of water-worn gravels consisting chiefly of rounded chert and quartz pebbles. Iron compounds have cemented the pebbles and sand together, in places. Their origin has already been described.

PLEISTOCENE.

The bottom lands of many of the rivers are in places underlaid with fine clay, sand and gravel. Rounded chert or quartz pebbles are found in beds one to two feet thick and also scattered through the clay. "It is believed," states L. C. Glenn (Ref. 33:122), "that this pebbly material was deposited by the melting of floating ice which may have drifted from the Ohio River during a ponded stage in the closing days of the Glacial period."

A fine loess mantles the uplands for some distance back from the Ohio River. It varies in depth from six to twenty feet, being thickest nearest the Ohio River.

RECENT.

Recent alluvial deposits occur along the river flood-plains.

PLATE VI. CORN ON THE BOTTOM LANDS OF OHIO COUNTY.

STRUCTURE.

The structure of the rock formations which compose the Western Kentucky Coal Field plays an important part in determining the areas where coal mining, oil and gas production and the development of other natural resources are carried on.

First, as already described, the Western Coal Field lies in the syncline into which the Cincinnati Anticline extends on the west. Across the Coal Field from southeast to northwest extends the axis of the Western Kentucky geosyncline, Fig. 2, passing through the counties of Hart, Edmonson, Butler, Ohio, the northeast corner of Muhlenberg, McLean, Hopkins, Webster and Union to the Ohio River. It caused strata that outcrop along the eastern and southern margins of the Western Coal Field to dip beneath the surface to considerable depths. Rock formations and coal seams that might otherwise have been eroded away long before the present age, are thus preserved. In Webster County can be found what is probably the longest column of Pennslyvanian rock formations and coal seams of the Eastern Interior Coal Field. In the central part of Webster County there is a strip of land six to ten miles wide, extending northwest-southeast in which the coal beds of economic importance lie in a syncline 1,000 feet or more below the surface. This depth is too great for mining at the present time. Coal 9, it is believed, is not over 1,500 feet deep anywhere in Webster County. This maximum depth of Coal 9, (Ref. 33:135), occurs over only a small area, around Mt. Gilead school. Elsewhere, Coal 9 should be found along the axis of the Webster syncline between 1,000 and 1,200 feet below the lowland drainage level.

North of the Western Coal Field geosyncline occurs the Rough Creek anticlinal fold and fault, Fig. 2. It extends from Leitchfield, Grayson County, through the center of the Coal Field to Shawneetown on the Ohio River. The faulting is complex, in some places being a thrust and in other regions a gravity fault. Throws varying from 1,500 to 2,500 feet have been discovered. Mississippian strata are brought to the surface in some localities along the fault. This structure has effected the area in which the coal seams may be found and their depth beneath the surface. It has also had an influence upon the accumulation of oil and gas.

Numerous other folds and faults occur throughout the Western Coal Field, as shown in Fig. 2. In Hopkins and Muhlenberg counties normal faulting has brought down Coals 9 and 11 which in certain regions would otherwise have been eroded away. A dip fault in the northern portion of the Hartford quadrangle has offset the outcrop of the Elm Lick coal, nine miles (Ref. 58:240,282). Faulting is extensive along the southern margin of the Coal Field and in adjacent areas. A fault which occurs along the edge of the Coal Field in Christian County is shown in Plate VII. Down faulting and erosion have resulted in forming outliers of Coal Measure strata, some of which contain coal, in Caldwell, Crittenden, Livingston and other counties.

PLATE VII. A FAULT IN NORTHERN CHRISTIAN COUNTY.
Exposure in a cut of the Louisville and Nashville Railroad. The downthrown Pennsylvanian formations have caused the hills of the coal field to rise abruptly above the Mississippian Plateau.

UNCONFORMITIES.

A great unconformity exists between the Mississippian and Pennsylvanian systems. Within the Pennsylvanian itself, a number of unconformities occur. They have been described in Ref. 33:130, 132. One is found at the base of the Sebree sandstone. A minor unconformity within the Carbondale results in cutting out Coal 9 in certain restricted areas. An unconformity is found associated with Coal 11, which has caused this seam to be absent over certain places. At the base of the Anvil Rock sandstone occurs another unconformity which may possibly effect the Baker coal. An unconformity is found at the base of the Dixon sandstone.

CHAPTER III

CLIMATE.

The Western Coal Field of Kentucky has the humid, continental type of climate. No marked peculiarity or modification of climate is caused by difference in elevation or latitude. The small variations in the average precipitation at the Weather Stations are probably due chiefly to the local exposure of the rain gauge and the relative length of time of the records. Western Kentucky is, however, somewhat warmer than eastern Kentucky in summer. In winter there is not much if any difference between these two divisions of the State, (Ref. 23).

WINDS AND STORMS.

The Western Coal Field lies within the path of the moisture bearing storms which move from the western Gulf region northeastward over the Mississippi and Ohio valleys to the Great Lakes region and the North Atlantic coast. These large storm areas, which vary in frequency, character and force, are the chief agents in determining the greater portion of the precipitation over this section.

The prevailing annual winds at the three weather stations are listed in Table I. The prevailing annual wind direction at Beaver Dam is from the south, Earlington southwest and Owensboro northwest. At all of the Weather Stations during the summer months, the prevailing winds are from the south and southwest. During the colder months the prevailing winds are from the northwest and north as shown in Table I. The northern portion of the Western Coal Field, as recorded by the Owensboro Weather Station, receives winds from the northwest for a longer period than any other part of this physiographic division.

The average hourly wind movement, in miles, as recorded at the Evansville, Indiana weather station, just across the Ohio River from Henderson County is as follows: The highest average monthly wind velocity occurs during March when the wind movement is 8.6 miles per hour; the lowest average velocity is

5.5 miles per hour during August; the average annual velocity is 7.2 miles.

TEMPERATURE.

The Western Coal Field has a mean annual temperature of 56.6 degrees. The variation between various parts of the area is small. Leitchfield just off the eastern border of the Western Coal Field strata but so near as to show practically the same climatic conditions as occur in the Coal Field proper, has a mean annual temperature of 55.9 degrees, Beaver Dam 56.6 degrees, Earlington 57.4 degrees and Owensboro on the northern border 56.7 degrees. The minimum and maximum mean annual temperatures for the Western Coal Field are 45.8 and 67.4 degrees respectively. Tables 2 and 3, show the mean monthly and annual temperatures and the mean maximum and minimum temperatures.

The summer months have an average mean temperature of 75.9 degrees varying between an average of 73.9 degrees in June and 77.7 degrees in July. It is usually drier during August than in July. The mean minimum and maximum temperatures for the summer months are 64.6 and 87.3 degrees respectively. The highest temperature for the Western Coal Field was 108 degrees, recorded in June at Beaver Dam and in August at Earlington. Low temperatures occur occasionally even during the warmer months, 39 degrees having been recorded in June, 47 degrees in July and 42 degrees in August. The highest monthly temperatures occurring in the various areas of the Western Coal Field are given in Table 4. Extremes of temperature, however, usually last only two or three days.

In the Western Coal Field the winter months have an average mean temperature of 35.5 degrees. The mean temperature for December was 36.4 degrees, January 35.5 degrees, February 34.6 degrees . The mean minimum and maximum winter temperatures are 26.5 and 44.2 degrees respectively. The lowest temperature for the Western Coal Field was —28 degrees which was recorded in February at Earlington. The lowest monthly temperatures for the Coal Field areas are given in Table 4. Even during the winter months the thermometer has sometimes risen as high as 76 degrees in January and 79 degrees in February.

The spring mean temperature is 56.2 degrees, the average monthly temperature increasing from 46.5 degrees in March to 66.4 degrees in May. The spring mean minimum and maximum temperatures are 45.2 and 67.1 degrees respectively.

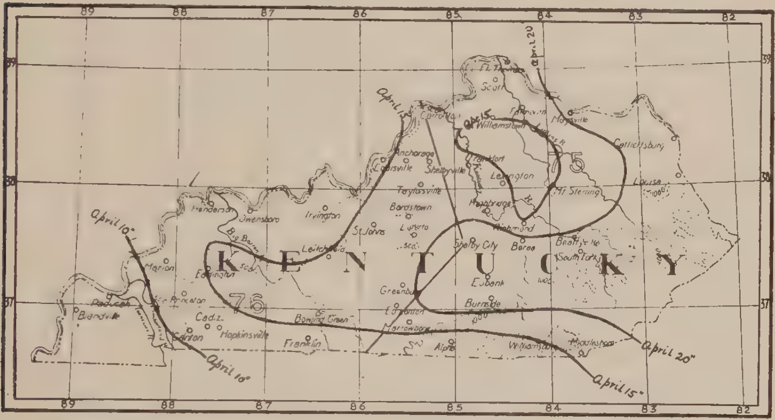

Fig. 3. Average date of the last killing frost in the Spring.

The autumn mean temperature is 58.7 degrees, the monthly average decreasing from 70.6 degrees in September to 47.0 degrees in November. The autumn mean minimum and maximum temperatures are 46.7 and 70.7 degrees.

Killing frosts occur and therefore should be guarded against. The average dates of the last killing frost in the spring and the first in the fall, are the dates about which the actual dates of the killing frosts fluctuate. The average date of the last killing frost in the spring is that time when the chances are even that there will or will not be a killing frost later. The same principle holds true for the autumn. The accompanying frost maps for Kentucky, Figs. 3 and 4, and the Tables 5 and 6, show that at Owensboro the average date of the last killing frost in the spring when the risk is 50 per cent, is April 12, and at Earlington April 15. The average earliest date of killing frost in the fall at Earlington is October 17 and at Owensboro October 23.

The farmer should know the percentage of risk from frost that his crops run at various dates in the different localities.

Tables 5 and 6 show the probability of killing frosts in the Western Coal Field. The use of these tables is shown in the following example. At Owensboro, Daviess County, the probable date of latest killing frost in the spring and the percentage

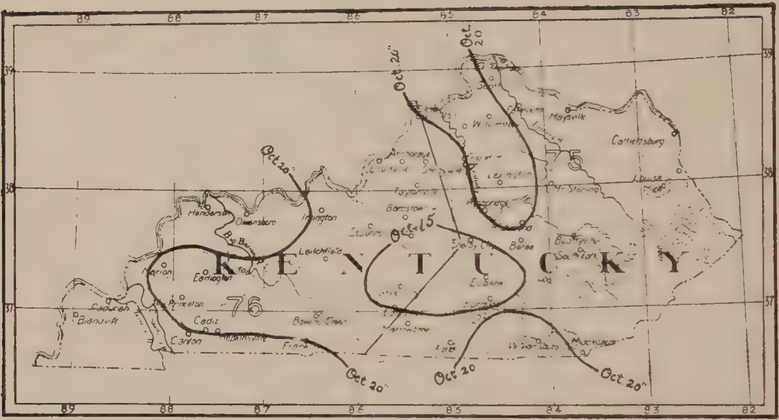

Fig. 4. Average date of the first killing frost in the Fall.

of risk are as follows: April 12, risk 50 per cent; April 17, risk 33 1/3 per cent or one year in three; April 20, risk 20 per cent or one year in five; April 28, risk 5 per cent or one year in twenty. The probability of killing frosts during the fall months are obtained from the tables in the same manner.

The earliest actual date in the Western Coal Field for the last killing frost in the spring, was March 26, 1912, recorded at the Owensboro Weather Station; the latest actual date being May 2, 1907, recorded at the same station. The earliest actual date for the first killing frost in the fall was September 30, 1899, recorded at both Earlington and Owensboro; the latest date being November 9, 1900, at the Owensboro Station.

The topography of a region sometimes has an important influence upon the extent of the area where the crops will be damaged by a killing frost. In a hilly region, crops in the valleys and on the lower slopes may suffer, while the higher areas remain unharmed. Severe frosts, however, may injure the crops even in the higher lands.

The length of the growing season is very important in its influence upon the kinds of crops grown and is generally taken as the number of days between the date of the last killing frost in the spring and the first killing frost in the fall. Figs. 5 and 6, Table 7, show the length of the growing season. Thus the probable length of the growing season at Earlington is from 177 to 197 days, and at Owensboro 182 to 206 days. Earlington is

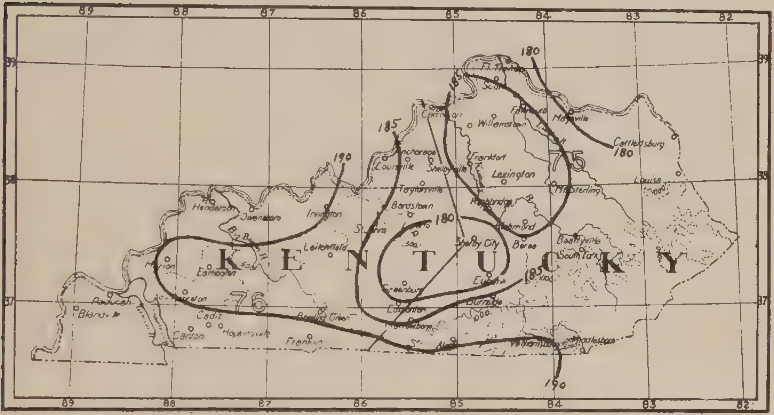

Fig. 5. Average number of days in the growing season.

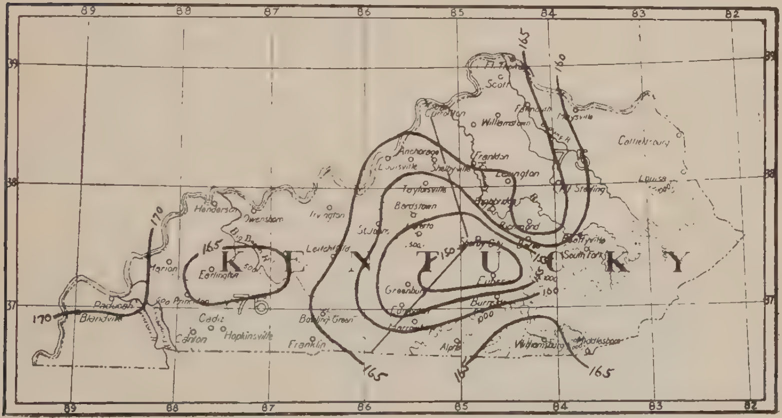

Fig. 6. Number of days in the growing season practically sure four years out of five.

practically sure of a growing season of 162 days and Owensboro 169 days. The shortest growing season on record was 153 days. This occurred at Earlington in 1908. The longest growing season was 222 days, recorded at Owensboro in 1912.

The length of the growing season, temperatures, precipitation, number of hours of sunshine and soils are favorable in the Western Coal Field for the production of numerous varieties of crops which will be discussed in this report under agriculture.

HUMIDITY AND PRECIPITATION.

The mean relative humidity recorded at Evansville, Indiana, just across the Ohio River from the Western Coal Field, is highest in January, being 84 per cent at 7 a. m. and 75 per cent at 7 p. m. The lowest annual mean relative humidity at 7 a. m. is 74 per cent in April and at 7 p. m., 57 per cent in May. The annual mean relative humidity is 80 per cent at 7 a. m. and 65 per cent at 7 p. m.

The average total number of days with .01 inch or more of precipitation for the Western Coal Field varies from 89 days at Beaver Dam to 102 days at Owensboro. The average number of days of annual precipitation for the entire Western Coal Field is 96 days. January, March, April and May lead the other months in the number of days with .01 inch or more of rainfall, each having nine days of precipitation. Months in which the fewest number of days of precipitation occur on the average are September with six days of rainfall, October five days and November six days. Thus October is the driest month of the year. The number of days of precipitation per month for each of the Weather Stations is given in Table 8.

The spring season has the greatest average total days of precipitation during the year, there being 27 days of .01 inch or more rainfall. Winter ranks second with 24 days, summer, 23 days and fall 17 days.

The average annual precipitation in the Western Coal Field is 45.15 inches. The average maximum annual precipitation is 47.61 inches. This occurred at Leitchfield near the Coal Field's border. The average minimum annual precipitation is 42.86 inches which occurred at Beaver Dam. Table 8 gives the monthly precipitation.

The average seasonal precipitation for the Western Coal Field is as follows: winter, 12.27 inches; spring 12.72 inches; summer, 10.99 inches; fall, 9.12 inches.

The heavy winter and spring rains make the dirt roads very muddy and difficult to traverse, except during the drier periods. In the rougher sections the roads and paths at times are almost impassible except on horseback. Spring and summer thunderstorms cause the dirt roads to become wet and slippery in an exceedingly short time. Heavy rains cause much soil erosion on the bare slopes and swell the streams as shown in Plate I.

The annual snowfall for the Western Coal Field averages a total of 13.5 inches. The greatest snowfall occurs in January. Table 9 gives the snowfall for each of the months in which it occurs. Sleet, ice storms and hail occur.

Since the ground remains unfrozen to any appreciable extent in winter, soils on slopes bare of vegetation are more subject to erosion than would occur under similar topographic conditions in the Northern States where the soils are frozen hard throughout the winter.

The per cent of possible sunshine in terms of hours of daylight for the entire year as recorded at the Evansville, Indiana, Weather Station, just across the Ohio River from the Western

PLATE VIII. ARTIFICIAL LAKE AT A COAL MINE.
North Central Muhlenberg County.

Kentucky Coal Field, is 65 per cent; summer 78 per cent; fall 66 per cent; winter 48 per cent; spring 65 per cent.

The effect of the sunshine and precipitation upon the growth of the crops is satisfactory. Usually there is enough rainfall during the growing season for the development and maturing of the staple crops. Occasionally too much rain falls, while in some years drouthy conditions occur. Even during these prolonged dry spells, occasional rains fall in sufficient volume to prevent too serious damage to the crops. On the average three drouthy years occur during every ten year period.

Water for the livestock on the farms is often collected in a pond formed by damming a small brook. The coal mining companies make sure of an ample supply of water by ponding it into reservoirs sometimes covering several acres, as shown in Plate VIII.

CHAPTER IV

NATURAL RESOURCES.

SOILS.

The soils of the Western Coal Field consist of: (1) residual soils which occur on the uplands and are derived from the bedrock, and some loess-like soils; (2) transported soils which are found in the bottom lands where they have been carried by streams and surface wash.

These soils have been sub-divided into various types. The first five types were classified and discussed by S. C. Jones, (Ref. 52). They are in general representative of the soils of the topographic regions of the Coal Field in which they occur, with occasionally some minor local variations.

Upland Soils.

(1) A yellow silt loam occurs in the hilly uplands. It was derived from the interbedded sandstone, arenaceous shales, etc. The surface soil is a yellowish or grayish silt loam. The subsoil is a bright yellow color and has more of the characteristics of a clay. Rainwater readily enters the surface soil and is retained by the subsoil for the use of plants. Much moisture, however, is lost to the atmosphere through the porous surface soil. A great deal of the water thus lost could have been kept in the ground if the amount of organic matter in the soil were increased. This soil being of a loose texture and situated on the hillsides washes easily, unless forests or some cover crop hold them in place. If these soils are cultivated, correct farm practice should be employed in the method of plowing, cultivating and rotation of crops. The chief crops grown are corn, tobacco, wheat and hay.

(2) A yellow silt loam occurs on the gently rolling, lower uplands. It is derived from the disintegration of the sandstones and sandy shales which form the country rock. This soil is deeper and usually contains more organic matter than the hilly silt loam which it resembles. The subsoil also resembles that of the hilly areas. Drainage usually is fairly good, but in

the more level regions it would be benefited by artificial drainage. This yellow silt loam of the undulating areas gives better yields of corn, wheat, tobacco and other crops than are obtained from the steeper hillsides. Care should be taken to prevent erosion, for even this gently rolling land washes unless proper farming methods are practiced.

PLATE IX. FARM SCENE IN UNION COUNTY.

Broad areas of upland soils, such as those of Union County, are loess-like in character. (Ref. 54).

Bottom Lands.

(1) A gray or yellowish silt loam forms the top soil along the smaller streams. It was washed down from the adjacent uplands. This process is still in progress. The result is that the valleys throughout great areas of the Western Coal Field are being filled up by sediments. Broad, flat bottom lands are developed. Exceptions are along the narrow bottoms at the headwaters of streams in the hilly regions of the uplands, and the V-shaped valleys of the rougher surfaced southern and eastern margins of the Coal Field. Where valley filling is taking place the bottom lands are damp and sometimes swampy. Better drainage is needed in order to secure the most favorable results agriculturally. Thousands of acres have been reclaimed by ditching, as described in this report under the topic of Drain-

age. Large areas of undrained land yet remain to be reclaimed. Corn and hay are grown on these bottoms when not too wet, but proper drainage often doubles the yield. Tobacco is produced on the higher soils when they are sufficiently drained. (Ref. 52).

(2) A gray clay loam is found along the river bottoms in certain regions. It occurs in eastern Webster County along Green River and Deer Creek, and in the western portion along the Tradewater River. It differs from the gray silt loam of the smaller streams' bottom lands in that the material of the gray clay loam has been brought by the rivers from the Chester, St. Louis and Waverly outcrops. (Ref. 52:151). This bottom land is often considerably dissected by erosion. The drainage is comparatively good, but the flatter areas need ditching and tiling. Corn and hay are grown.

(3) A dark brown clay loam occurs in the bottom lands and is similar in origin and the localities in which it is found to the gray clay loam. It has a higher elevation than the gray clay loam, and is underlain by material resembling the gray clay loam. The dark brown clay loam will bake hard in the sun. It needs to be drained before being farmed. Corn, wheat, hay and occasionally a patch of tobacco are grown.

(4) The Ohio River bottom land is of Recent origin. It is being added to by deposition of sediments during overflow of the Ohio River. A dark brown clay occurs over wide areas of the Ohio River bottoms in Union County. Nearer the river this clay is often mixed with sand which makes the soil easier to cultivate. The lower bottoms are liable to overflow with resulting damage to the crops. Corn is planted to a great extent. The "second bottoms," are usually safe from damage by flood. Wheat, oats, hay and tobacco are grown with good results.

(5) A fine sandy loam, and often loose sand sometimes devoid of vegetation, occurs in low, usually narrow ridges closely bordering the Ohio River. These ridges, or natural levees, were deposited during time of flood. Corn is grown. Spots too sandy for other crops produce excellent watermelons, according to H. W. Mareau. (Ref. 54:438).

CLAY.

Clay and shale of the Western Coal Field which are suitable for use in the clay products industry are as follows: (Ref. 75: 61).

(1) Clays and loams of river flood-plains and terraces are used for common face brick and drain tile.

(2) Certain shales of Allegheny age are satisfactory for brick, tile, and hollow blocks. It is possible that at least one shale might, in one instance, be suitable for the making of stoneware.

(3) Residual clay from the Pennsylvanian strata and clays associated with some of the coal seams are suitable for use in the clay products industry. Fire clay underlying a coal bed is mined at Lamkin and Hawesville, Hancock County.

(4) Just below the Pottsville in Edmonson, Hart, Taylor and perhaps other counties, occurs a white dense clay with conchoidal fracture, that is called ''kaolin.'' Thus far it has been found only in pockets too small in size to be of economic value. This ''kaolin'' resembles the Indianaite of Indiana.

A description of the various clay products companies utilizing the above mentioned types of deposits which are of economic importance, is given in Chapter IX.

SAND AND GRAVEL.

Excellent glass sand from which all types of glass can be made, occurs in the Western Coal Field. This sand was originally laid down as pure quartz grains, unmixed with foreign matter, in seas that covered the regions where it is now found. The sand consolidated into rock, which is now in many instances rather friable. Prof. C. H. Richardson (Ref. 74:137) states: ''These sands appear to be the equal of the best glass sands of America. It must be remembered that these sands have been analyzed as unwashed sands, ... and, as washing removes a large amount of the iron and alumina from the sand, these two factors would run much lower in a washed sample and the silica correspondingly high. Yet the silica content of the unwashed samples is approximately 99 per cent.'' This type of glass sand as friable sandstone, is found about one-fourth mile south of Dawson Springs, Hopkins County, (Ref.

74:104) on both sides of the Illinois Central Railroad, and can be traced for several miles. It has been noted that this sandstone extends southward toward Claxton on the Illinois Central Railroad for at least five miles and that the supply of glass sand is nearly inexhaustible. Water with which to wash the sand could be obtained from the Tradewater River. The Illinois Central extends through this glass sand deposit. Glass sand is also found elsewhere near Dawson Springs. Glass sand has been reported near Madisonville, Hopkins County (Ref. 74:105).

Near Horse Branch on the border of Grayson and Ohio counties occurs a sandstone which would make a good common glass (Ref. 74:119). Ohio County contains a sand from which could be manufactured window glass, bottles and the like (Ref. 74:122).

A sandstone near Caseyville, Union County, is considered well suited for hearth-stones due to its refractory character (Ref. 74:127).

On the border of the Western Coal Field in Grayson County is a strip of glass sand extending from Tip Top in Hardin County to Leitchfield, Grayson County.

Some of the Ohio River sands after being washed and screened, are glass sands, the coarser material being of value for use in cement and concrete. Gravels secured along the Ohio River are used quite extensively on the roads around Owensboro and Henderson, and in the other Ohio River counties. Ohio River sand and gravel is also shipped to more distant markets. Residual gravel derived from the Pottsville conglomerate can be secured in some places along the outcrop of this formation.

Building sand can be obtained in Webster County from the Vanderburg and Dixon sandstones where disintegrated, while the more solid sandstone could easily be crushed if necessary (Ref. 33:145).

Building Stones.

The Western Coal Field proper contains Pennsylvanian sandstones and limestones suitable for building and other purposes. Few quarries, however, have been opened. The Mississippian formations bordering the coal field strata in certain of the perifery counties, are quarried to some extent.

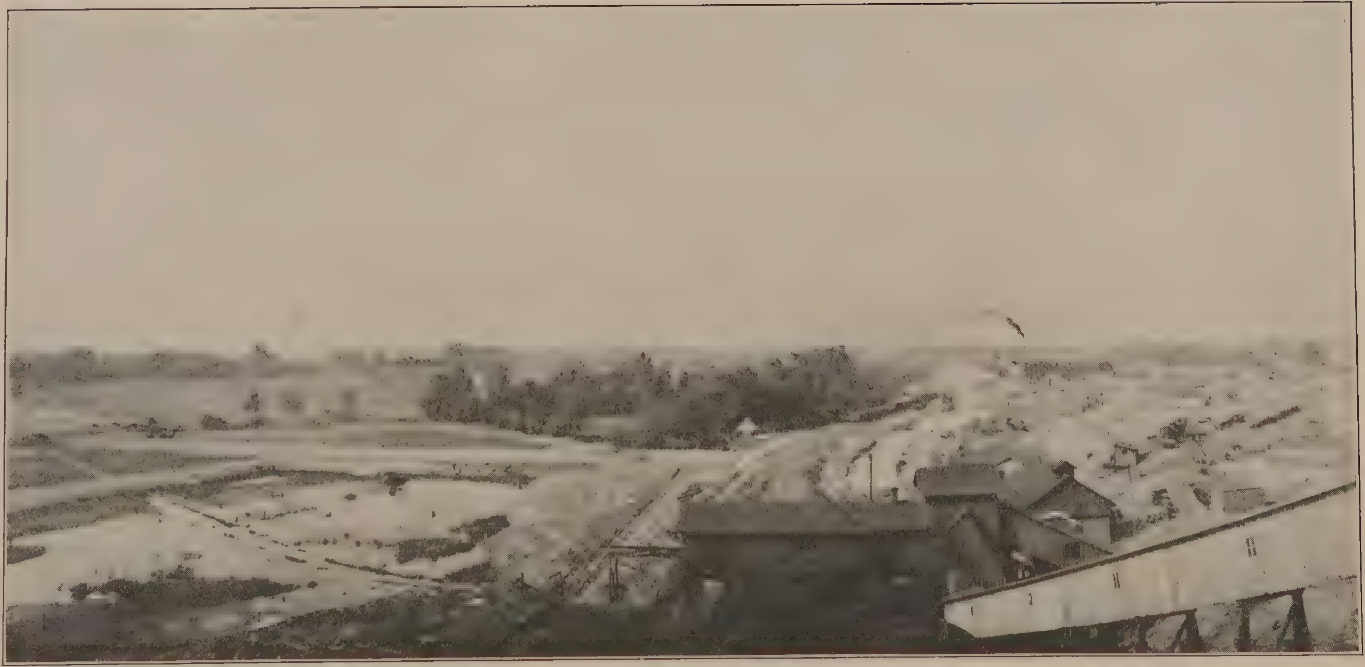

PLATE X. PANORAMA OF A PORTION OF THE SUNLIGHT MINING COMPANY'S PROPERTY NEAR MADISONVILLE, HOPKINS COUNTY.

Near Hawesville, Hancock County, there is a sandstone quarry, the stone being used for foundations and curbing.

Hopkins County has an unusually large number of quarries in comparison with the majority of the other counties in the Western Coal Field. These quarries are as follows (Ref. 73:250, 251). From the Major M. K. Gordon quarry and the Browning Springs quarry, both in Madisonville, a bluish gray limestone is obtained. It is used for foundations, culverts, bridges and curbing. The Sunlight Mining Company in the mining of its two seams of coal, quarries the bluish gray limestone which comes between coals Nos. 11 and 12 in the strip pit shown in Plate XXXVIII. The limestone is crushed in the mill of the Sunlight Crushed Stone Company, Plate X, located near the pit and sold for agricultural lime and road metal.

There are some old abandoned sandstone quarries in the Grampan Hills near Madisonville and another inactive sandstone quarry near Dawson Springs. Drake's Creek sandstone quarry is two and one-half miles southeast of Nortonville on the Louisville & Nashville Railroad.

At Oak Hill quarry, one mile north of Nortonville on the Louisville & Nashville Railroad, a sandstone is obtained. It is used for foundation work, pillars, bridges, culverts and the like.

The Marion Page sandstone quarry is two miles north of Nortonville on the Louisville & Nashville Railroad.

Massive sandstone occurs along the Green River in McLean County, and there is a quarry near Calhoun, the stone being used for foundation work. (Ref. 73:252).

Muhlenberg County has four quarries, each known as a Mack Ferguson quarry. One is one-half mile west of South Carrollton where a limestone is quarried for road purposes and burned for lime. The second is one-half mile north of the same town. It is a buff sandstone, six to ten feet thick near the top of the pit, with a gray sandstone four feet thick forming a middle layer, and twenty feet of fine-grained, even textured, blue sandstone at the bottom. (Ref. 73:252). The third quarry is near the number two quarry just described. The fourth sandstone quarry is within the town of South Carrollton.

Just outside of the town near Green River is another quarry in the same sandstone as mentioned above.

The Earnest Purdy quarry on the east bank of Green River was not being operated (Ref. 73:253).

Along the Tradewater River in the southern part of Union County, occur massive thick-bedded sandstones which, according to Prof. C. H. Richardson, "should furnish some good quarries." (Ref. 73:254). A small amount of sandstone has been quarried for foundation work near Morganfield. This same authority also calls attention to limestone strata near Providence, and thick-bedded sandstones along the Tradewater River in southwestern Webster County, where the rock itself is favorable for quarrying operations. No quarries, however, are in operation in these strata.

Several rather thin Pennsylvanian limestones occur which are low in magnesia, and due to their location near coal beds and shales may prove of value for Portland cement.

COAL.

The Western Coal Field of Kentucky forms the southeastern portion of the great Eastern Interior Coal Field which also includes the States of Indiana and Illinois. Coal is the chief natural resource being developed in the Western Coal Field. Bituminous coal and a small quantity of cannel coal are mined. No lignite or anthracite occur. These coals of the Kentucky portion of the Eastern Interior Coal Field are, in general, higher in average combustible matter and fixed carbon, and lower in average moisture, ash and sulphur than the coals of other portions of the field. Thus the coals of the Western Kentucky Coal Field are of a better average quality than the coals of the remainder of the Field in Indiana and Illinois. (Ref. 33:134).

Average analyses of the most important coals of the Western Coal Field (Ref. 33:175), are as follows:

AVERAGES OF ANALYSES OF EACH COAL
Air Dried Basis.

Coal	No. of Analyses	Loss Air-drying	Moisture	Volatile	Fixed Carbon	Ash	Sulphur	B. T. U.	Ratio Fuel
No. 6	2	5.35	3.40	38.04	50.36	8.19	3.46	13,676	1.32
No. 9	31	3.25	3.68	37.58	49.47	9.25	3.56	12,752	1.31
No. 11	24	2.70	2.86	38.88	49.14	8.65	3.74	12,860	1.26
No. 12	1	1.60	1.96	41.40	47.55	9.09	4.44	13,013	1.15
No. 14	15	2.22	3.27	35.90	52.10	8.72	1.54	13,087	1.45
Av. of all	73	2.88	3.33	37.73	49.90	8.91	3.22	12,898	1.32

Additional analyses of Western Kentucky coals can be found in References 33 and 71.

It is said that Western Kentucky coal possesses advantages in stocking and is less liable to spontaneous combustion than coals from the adjoining States. With regard to fusibility of ash, the coals of the Western Kentucky Field are generally classed as easily fusible ash, softening below 2,200 degrees F. (Ref. 71:16). Coals Nos. 9 and 11 are coked to some extent. The high sulphur content of some of the coal, however, makes the coke undesirable for use in the iron and steel industry although it can be put to other purposes. The chief value of the Western Kentucky coals is for steam raising on the railroads

PLATE XI. MADISON COAL CORPORATION.
Central City, Muhlenberg County.

and in industrial plants, and for domestic use. A little coal is sold for the manufacture of gas.

The Western Kentucky coals occur in a total maximum thickness of 3,000 feet of strata. At one given location the thickness is probably not over 2,500 feet, often much less. Within this geologic section there are known to be at least 40 coal seams. Of these seams the ones of greatest economic value at present, are 1B, 6, 9, 11, 12 and 14. A few of the other coals shown in the geologic section on the map of Webster County, 1922, by Glenn, are of local importance. (Ref. 33:135).

In Grayson and Edmonson counties in the Nolin River region, is a coal averaging 36 inches in thickness which comes above the lower conglomerate. It has also been worked in Warren County. Coal beds below the No. 9 seam have been worked in a small way in Butler and Logan Counties.

The following section by A. M. Miller (Ref. 58:284) shows the coal seams opened below Coal 9, their average thickness and intervals as they occur in Butler, Logan, Ohio and Muhlenberg counties:

Mining City, No. 6(?). Thickness 36 inches.
Interval 75 feet.
Mannington, Dunbar, Topmiller. Thickness 36 to 48 inches.
Interval 100 feet.
Elmlick, No. 3, Aberdeen, Deanfield, Mud River. Thickness 36 inches.
Interval 100 feet.
Foster. Thickness 30 inches.
Interval 20 feet.
Gidcomb. Thickness 48 inches.
Interval 245 feet.
Main Nolin, No. 1-B(?). Thickness 36 inches.
Interval 10 to 160 feet.
Chester Group.

A cannel coal, 22 to 38 inches thick, is found in Breckinridge County about 40 feet above the base of the Coal Measures. (Ref. 58:283). The Pottsville conglomerate does not occur in this area.

In Christian County a coal seam is mined that is called the Mannington or Empire. At Empire this coal averages 44 inches thick. It is the same bed as the Dawson Springs of Hopkins County, according to A. M. Miller (Ref. 58:283), who states, "it is suspected to belong at a horizon between Numbers 3 and 4."

"In Hancock County," writes Prof. A. M. Miller (Ref. 58:283) "four seams are mined." His section is as follows:

Lewisport. Thickness 48 to 60 inches.
Interval 30 to 60 feet.
Adair. Thickness 24 to 42 inches.
Interval 25 to 35 feet.
Lead Creek (limestone seam). Thickness 36 to 42 inches.
Interval 25 to 35 feet.
Hawesville. Thickness 42 inches.
Interval 75 feet.
Top of Caseyville Conglomerate.

"Of the foregoing." continues this authority, "the Hawesville and the Lewisport are the most important seams. There is little certainty as to the identity of these coals. It has been suggested that the lowest may correlate with the Number 1-B, or perhaps the Number 2, and the upper with the Number 9."

Continuing geologically upward in the Western Coal Field strata, the next coal to be considered is the I-B, also known as the Cook or Bell coal, 28 to 38 inches thick, and the No. 6, 48 to 51 inches thick, these seams being in the Tradewater formation of the Pennsylvanian. They have been discussed under the topic of geologic formations.

Coal 9, also called the Springfield seam, of the Carbondale or Allegheny formation of the Pennsylvanian (Ref. 33:113), underlies about 25,000 square miles in the Eastern Interior Coal Field and is probably the most persistent coal bed in the eastern half of the United States. In area it far outranks the Pittsburgh coal which occurs over about 6,000 square miles. Coal 9, is 56 to 58 inches thick. It is extremely regular in occurrence and thickness and is of immense economic value. Analyses of this seam are given on page 37.

Coal 11, also called the Herrin seam, of the Carbondale is found over a wide area and is of great economic importance. The interval between Coals 9 and 11 varies from 60 to 125 feet. The usual distance is 80 to 90 feet. Coal 11 has a normal thickness of 60 to 73 inches. The thickness, however, is variable. The thinner portions of the seam are where the coal was eroded by streams, while the thicker sections are the result of a greater deposition of vegetable matter in depressions in the floor of the swamp where the dead vegetation was undergoing the first changes in its transformation into coal.

When Coal 11 occurs in its usual thickness, it can be identified as follows (Ref. 33:90): A parting of blue or gray clay one and one-half to two inches thick, known as the "blue band," separates the lower third of the coal bed from the remainder of the seam; in the upper two-thirds of the coal, about 9 to 16 inches from the top, there is usually a pyrite or sulphur band, varying in thickness from a mere streak to one-fourth to one-half inch in thickness. Thus the blue and pyrite bands separate the coal into three parts. Coal 11 can also be identified in the western half of the Western Coal Field by the Providence limestone which occurs just above Coal 11. This limestone is distinguished by its Fusulina cylindrica fossils which L. C. Glenn (Ref. 33:98) states he has not found anywhere in the western half of this Coal Field, except in the Providence Limestone.

PLATE XII. COAL MINING IN UNION COUNTY.

Property of the Morganfield Coal and Coke Company, Morganfield. Coal No. 11, is being mined, and the shaft is to be deepened to coal No. 9. Photo taken summer of 1923.

Coal 12 of the Carbondale comes above the Providence limestone. The vertical distance between coal seams 11 and 12 varies from 4 to 22 feet. Coal 12 varies in thickness from a thin sheet to seven feet and over.

Coal 14, or the Baker Coal, occurs near the lower part of the Lisman formation, Pennsylvanian system. Glenn states (Ref. 33:108), that this seam is the same as the Nebo coal and is found about Nortonville, Hopkins County, and Corydon and Smith's Mills, Henderson County. The Baker coal is found up to seven feet thick, but the areas of workable thickness are rather local, the seam thinning rapidly in some places. The coal is of excellent quality.

PLATE XIII. AN OIL WELL ON THE WILLIAMS-HOLLOMAN LEASE. Somewhat southward from Morton's Gap, Hopkins County.

Oil and Gas

The Western Coal Field has not been thoroughly prospected with the drill and without doubt valuable pools of oil and gas will be discovered from time to time as development work goes on. Many geological structures favorable to the accumulation of oil and gas occur. Areas now productive or formerly productive will be described.

The Bear Creek Gas Field is located in the northern part of Edmonson County. A small dome structure occurs. This gas has no commercial outlet.

Grayson County has yielded a number of oil and gas wells of commercial importance. The Caneyville oil pool is located in southwestern Grayson County. Oil is obtained from Waverly strata. The structure is associated with the Rough Creek fault and fold (Ref. 48). The Leitchfield oil and gas field is near the town of that name just outside of the Coal Field area. Gas is secured at a depth of from 700 to 1,200 feet, from a partial dome developed by the Rough Creek fault and fold. The anticline extends in a general east and west direction. The rocks containing the gas are porous strata of the St. Louis limestone

(Ref. 40:55). The gas is used in Leitchfield. The Meredith gas field is located about one and one-half miles southeast of Meredith Post Office, and ten miles southeast of Leitchfield, Grayson County. The surface rocks are of Pottsville age. The initial well was drilled in 1917. Gas was secured from the "Major sand" of the Mississippian system at a depth of 1,160 feet. The structure is known as the Meredith dome (Ref. 40:63).

PLATE XIV. OIL TANKS ON THE WILLIAMS-HOLLOMAN LEASE. Hopkins County.

Oil was found near Corydon Post Office, Henderson County, in 1922 but has never been produced in commercial quantities.

An oil field was discovered in 1922, a short distance southward from Mortons Gap, Hopkins County, on what is known as the Williams-Holloman lease, Plate XIII. The oil has accumulated in an anticline to the south of which there is a fault. Up to August, 1923, the oil that had been secured was stored in the tanks shown in Plate XIV.

The Hartford oil pool is located between Sulphur Springs and Hartford, Ohio County. The pool is situated on the south flank of the Rough Creek anticline. Production is secured from Waverly sandstone, (Ref. 48).

An oil and gas pool occurs near Pellville along the Hancock-Ohio County line. The structure is anticlinal.

The Central City gas field is near Central City, Muhlenberg County. The gas occurs in Pennsylvanian rocks.

The Penrod gas field is situated in southeastern Muhlenberg County on Rock Creek. The wells are about 700 feet deep. The gas and some oil are obtained from Pottsville sands. (Ref. 40:31, 59).

For additional data relative to oil and gas pools see the recent report of the Kentucky Geological Survey entitled "New Oil Pools of Kentucky," by W. R. Jillson.

Several small oil wells have been drilled in Union County. The Rough Creek fault and fold bisects this county in a northwest-southeast direction. (Ref. 48:171, 172).

In Webster County a well was drilled during 1913 or 1914 near Sebree Springs. At 2,100 feet and 3,185 feet good showings of oil were obtained. Considerable gas also was discovered. After shooting the well no more oil could be secured. Salt water now fills the hole. (Ref. 33:172). A discussion of the possibilities of obtaining oil and gas in Webster County is given by L. C. Glenn in Reference 33.

The Diamond Springs gas field is located in northwestern Logan County near the Diamond Springs Post Office. The surface rocks are of Pottsville and Chester age. Gas is obtained from the limestone beneath the Ohio shale. The structure is monoclinal with the dip to the northwest. The wells are about 700 feet deep. Many of the wells were drilled in 1910. This pool is no longer of commercial importance. (Ref. 40:31, 58).

Important oil pools occur comparatively near the Western Coal Field strata as in Warren County.

Oil Shale.

The Western Coal Field has some bituminous shale of Pottsville age from which oil can be distilled. A sample of this shale was taken from Webster County to determine its oil content. It had a specific gravity of 2.197, weighed 136.92 pounds per cubic foot, and yielded 8.25 gallons of oil and 5,000 cubic feet of gas per short ton. (Ref. 43:7, 9, 18). Shale with such a low oil content could not compete with the richer Ohio oil shale of the Knobs. Unless richer deposits of oil shale are discovered in the Western Coal Field the oil shale industry can be successfully developed only after the higher yielding oil shales of the Knobs region have become exhausted.

Rock Asphalt.

Kentucky rock asphalt which occurs in the Western Coal Field, is a sandstone impregnated with bitumen. It originally was an oil sand which has been uncovered by erosion. The more volatile hydrocarbons evaporated leaving the bituminous residue coating each sand grain. This asphaltic covering of the sand grains acts as a waterproof cement. The asphalt rock is quarried, crushed, pulverized and used for surfacing roads. Too low a per cent of bitumen is detrimental to the wearing qualities of the product. Sandstone lacking sufficient and uniform distribution of bitumen among the sand grains, might be increased in value by the addition of enough asphalt to raise the bitumen content to the necessary amount.

PLATE XV. A BARGE LOADED WITH ROCK ASPHALT.
Scene on Bear Creek, western Edmonson County, on the property of the Natural Rock Asphalt Company. Photo by W. R. Jillson.

Roads made from Kentucky rock asphalt which contained the proper percentage of bitumen, have given satisfactory service in Buffalo, N. Y., for the past thirty years. Many other instances can be cited. This necessary percentage of asphalt in the sandstone is found in Edmonson County deposits which usually contain about seven to eight per cent of asphalt distributed around the individual sand grains.

Analysis of rock asphalt from Edmonson County is as follows:

Analysis	Per Cent.
Moisture at 104° C.	0.35
Combustible matter	8.00
White sand	91.65
Total	100.00
Bituminous matter extracted by carbon disulfid	8.15

(Ref. 43:53.)

PLATE XVI. KYROCK, EDMONSON COUNTY.

View from the quarry of the Kentucky Rock Asphalt Company. In the foreground is the tramway and mill. The wharf and town along the Nolin River are in the background. Photo by W. R. Jillson.

Rock asphalt deposits occur along the southern and eastern edge of the Western Coal Field in the Mississippian and the Pottsville sandstone of the Pennsylvanian. The rock asphalt occurs in Breckinridge, Grayson, Hart, Hancock, Ohio, Muhlenberg, Edmonson, Plates XV, XVI, Butler, Logan, Warren and Hardin counties. The beds impregnated with bitumen are from five to forty feet or more in thickness. (Ref. 43:43).

The largest rock asphalt plant is that of the Kentucky Rock Asphalt Company, Plate XVI, situated on the Nolin River at Kyrock in Edmonson County. The rock after being quarried and pulverized is delivered to barges on the Nolin River. The barges are then towed by tugs down the Nolin and Green Rivers and up the Big Barren River to Bowling Green where the rock asphalt is placed in storage or loaded into railroad cars for shipment. Another operation, owned by the Natural Rock Asphalt Co., is located on the lower waters of Bear Creek in Edmonson County. The asphalt here produced is of Pottsville age and of excellent quality.

Rock asphalt is a very valuable natural resource of the Western Coal Field. As yet it has been only slightly developed but before opening up a rock asphalt deposit the cost of mining, crushing, pulverizing and transportation to market should be carefully reckoned.

IRON ORE.

Iron ore occurs along the edge of the Western Coal Field in hollows formed by erosion of the Mississippian limestone upon which the Pennsylvanian strata were deposited. The same iron ore is found beneath the tongue-like projection of Pottsville strata in Green, Larue and Taylor counties. Prof. A. M. Miller (Ref. 58:314) states that in the early days a furnace for smelting this iron ore was erected in western Green County. No evidence of this furnace now exists except the slag which came from it, but in this region nowadays occasionally a teakettle can be found which was made from the iron of this furnace.

An iron carbonate (siderite) ore is found in Muhlenberg County, above the Number 12 coal. According to A. M. Miller (Ref. 58:317), this iron ore was first smelted in a furnace built in 1837 by A. H. Buckner at the junction of Pond and Salt Lick Creeks, five miles south of Greenville. In 1857, the Airdrie Furnace was built on the banks of Green River near the town of Paradise. This was a Scotch venture. The money was furnished by Sir Robert S. C. A. Alexander. His business was not successful.

At present, due to the high grade iron ores of the Lake Superior and other regions, iron mining is not an industry of the Western Coal Field. The deposits, however, await a time when the high grade iron ores will have become exhausted and it will be necessary to draw upon the low grade ores. They thus form a potential source of wealth for the Western Coal Field.

Barite is reported in Union County.

WATER RESOURCES.

The Ohio and Green Rivers are navigable by steamers of considerable size. Dams and locks aid the river traffic. A description of these rivers has been given elsewhere in this report.

Drinking water is obtained by means of open and drilled wells. The depth of these wells varies according to their topographic location and the character of the underlying strata. Wells located on the river bottoms go but a short distance to water, while in other places the water bearing formations of the Pennsylvanian may be at a greater depth. For example, a well in Daviess County at St. Joseph's is 100 feet deep, while in certain other places in the Coal Field the water comes to the surface in springs.

From a sanitary standpoint the open wells are dangerous as they are easily polluted. The drilled wells are better if their water is not contaminated by underground seepage. Water is obtained from one kind of drilled well by means of a metal cylinder having a valve in the lower end. The cylinder is lowered into the well by a rope. On striking the water the valve opens and the water rushes into the tube. When the cylinder is pulled upward the valve closes preventing the water from escaping. The water in a well of this type might become polluted either by having some refuse fall into the well, or by the cylinder becoming contaminated when it is at the surface. Deep drilled wells that are covered tightly by a pump are the most sanitary. Occasionally farms have cisterns to hold the rain-water. Some cistern water is unsanitary.

The source of water supply for the cities and towns of the Western Coal Field is an important problem.

Owensboro obtains its water supply from deep wells. It was rated "good" by F. C. Dugan, Director of the Bureau of Sanitary Engineering, in a communication to the writer.

Henderson which has a complete water works plant, secures water from the Ohio River. The water is allowed to settle. It is then filtered and treated chemically. If there is no turbidity whatever the water is passed through cylinders containing Ultra Violet Rays. These electrical light rays purify the water of any germs that it may contain. The liquid chlorine method of sterlization is also used at the Henderson plant. The water as delivered to the city is pure.

Some towns and cities obtain their water supply from nearby rivers and use the water without any treatment. In other communities the water is obtained from reservoirs. Deep wells have been drilled in certain towns to obtain water.

Many improvements can be made throughout the western Coal Field to protect the water used by the inhabitants, from contamination. Filtering and chemical treatment of the water will prove a good investment.

Mineral water occurs at various places. At Dawson Springs, Hopkins County, water is obtained containing magnesium and calcium carbonate, magnesium sulphate and ferrous carbonate. At Calhoun, McClean County, a saline water is found in a well 29 feet deep. Analyses of water from different counties of the Western Coal Field are given in References 68 and 69.

NATIVE VEGETATION.

Great forests covered the Western Coal Field in pioneer days. The valuable trees, however, have been mostly cut, although in the bottom lands and on some of the steeper slopes trees of commercial value yet remain. Plates XVII, XLIX show a number of the large logs ready for shipment from stations in Webster and Ohio counties.

In the hilly uplands the native trees are beech, maple, hickory, persimmon, sassafras, walnut and the different varieties of oak. On the gently rolling land the native vegetation sometimes differs slightly from that of the hilly areas. In these regions oaks predominate on the hills, while on the rolling land maple and beech more often occur. (Ref. 52:145).

In the bottom lands the gray silt loam which may be wet and swampy, has a growth of black oak, red oak, sweet and black gum, sycamore and elm. The gum trees are common to wet flats. Timber on the gray clay loam is often scrubby. It consists of post oak, red oak and hickory. On the dark brown clay loam, the native trees are sweet gum, oak and hickory. (Ref. 52:148, 151, 154).

Among additional trees found in the Western Coal Field proper, according to H. Garman (Ref. 30), are ash, Ohio and sweet buckeye, butternut, red cedar, wild black cherry, chestnut, cottonwood, narrow-leaved crabapple, cucumber tree, flowering dogwood, holly, ironwood, yellow poplar, pawpaw, Kentucky coffee tree, locust and sumach. The bald cypress and pin oak are found in swamps. The river birch is closely confined to river banks. Smooth alder is common in wet places. Along the banks of streams and openings in the woods, witchhazel occurs. The wild plum is frequently found in thickets. Black jack oak is common especially on poor soils. Among trees often found in mountainous counties are the umbrella tree and the great leaved magnolia. The pecan occurs in the bottom lands along the Ohio River. In Edmonson County grow the scrub

PLATE XVII. LOGS AND MINE TIMBERS AWAITING SHIPMENT.
Scene at Blackford, Webster County.

pine, sage willow, waahoo and sourwood. Hemlock is found locally along the Green River to Edmonson County and then northward in gullies. Although not common in Kentucky, the American and large-toothed aspen occur in Edmonson County. Sweet birch is reported in McLean County. In Muhlenberg County the downy poplar grows locally in swamps and the catalpa on the bottom lands. Basswood is found in Daviess County and the basket oak is common locally on low ground in Hopkins County.

Also there occur prickly ash, bittersweet, clematis, wild black currant, hackberry, hercules club, hop tree, wild hydrangea, poison ivy, mountain laurel, mistletoe, red mulberry, black raspberry, service berry, spice bush, trumpet creeper, Virginia creeper and wisteria. Common on wet ground along ditches and streams is the button-bush, while the coral berry is found along roadsides and thickets. In the mountainous topography occurs the dockmackie. The American bladder-nut and common buckthorn grow in Edmonson County and the cross-vine in Edmonson and Ohio counties. In shaded places along the Nolin River the leatherwood, a common mountain shrub, is found.

WILD ANIMAL LIFE.

When the pioneers first came to the Western Coal Field they found game abundant. Since those days, however, the wild animals have decreased in numbers, some kinds becoming extinct in this region.

The usual birds may be seen. Wild doves, beautiful, slender, gray birds, are found.

Among the snakes are the copper-head and the rattlesnake. They are the only really dangerous animals that still survive.

The four-footed animals found are a few foxes, opossums, rabbits, squirrels, woodchucks, skunks and other small creatures.

Fish are caught in the Ohio, Tradewater, Green and Rough Rivers, and in smaller streams.

CHAPTER V

THE LAND AND ITS USES.

UNIMPROVED LAND.

The unimproved land in the Western Coal Field may be divided into the following classes which merge into one another: (1) commercial woodlands; (2) swampy or poorly drained territory adjacent to rivers and smaller streams; (3) districts where the forests have been cut off, the land now being covered with underbrush and second growth timber or ruined entirely by erosion; (4) slopes which were cultivated and often overcropped, but were not protected with cover crops against erosion with the result that they have been gullied by surface wash; (5) regions where the soils are too rocky or too steep for cultivation.

Counties of the Western Coal Field which had the greatest per cent of land surface unimproved in 1910 and 1920 respectively, due to one or more of the above causes, were as follows: Edmonson 58.8 per cent, 54.4 per cent; Muhlenberg 55.3 per cent, 58.4 per cent; Butler 49.3 per cent, 50.3 per cent. These counties have, in general, a hilly topography. Counties having broad expanses of Ohio river bottoms and gently rolling surfaces over great areas of their territory, had smaller per cents of unimproved land than the hilly districts. Thus Union County in 1910 had 13.8 per cent of its area unimproved, in 1920, 20.7 per cent; Henderson County 27.8 per cent and 20.7 per cent unimproved; Daviess County 25.6 per cent and 34.1 per cent unimproved. Although some of the unimproved land in these counties is due to loss of soil by erosion, and steep, forested or rocky slopes, much of it is wet or swampy land that can be reclaimed by drainage. Tables 10 and 11 give the per cent of unimproved land for the various counties.

On the individual farms, it is usually found, that the rougher the surface, the greater is the acreage of unimproved land. Thus Butler in 1920 had 46.0 per cent of its farm land unimproved and Edmonson County 45.2 per cent unimproved. In contrast, Daviess County had 16 per cent of its farm land unimproved, Henderson 15 per cent and Union only 10.1 per cent unimproved. From Table 11 similar statistics can be reckoned for the remaining counties.

It is a good thing to have a high percentage of unimproved land per farm on the steeper slopes provided the surface is in forest, for the vegetation prevents soil erosion. But many of the steeper slopes throughout the Western Coal Field are being deforested and cultivated until their fertility is exhausted or they are ruined by soil wash. Then they are abandoned to be gullied by erosion or to support such second growth timber and underbrush as is hardy enough to gain a foothold.

An increase in the per cent of total land surface unimproved occurred in eight of the Western Coal Field counties from 1910 to 1920. The Western Coal Field as a whole, in 1910 had 38.6 per cent of its land surface unimproved and in 1920, 41.1 per cent unimproved.

A study of the distribution of the unimproved land in woodland shows that the more hilly and rugged counties of the Western Coal Field have a greater acreage in woodland per square mile of their total area than the more level counties. Among the rougher surfaced counties Edmonson ranked first in 1910 with 320.1 acres in woodland per square mile of area and in 1920 still led with 226.4 acres of woodland per square mile. Butler County came second with 238.6 acres in woodland per square mile in 1910 and 211.5 acres in 1920. Outside of the rougher areas, thousands of acres of second growth timber with some large trees still standing, cover river bottoms, flat filled-in valley lands and the hillsides throughout the Coal Field. Large tracts of forest are owned by coal mining companies, the timber to be used ultimately at the mines. The more level counties had far smaller acreages in woodland. Thus Daviess County in 1910 had 44.8 acres in woodland per square mile and 34.0 acres in 1920; Union 58.3 acres in woodland in 1910 and 42.8 acres in 1920.

There was a decrease in woodland in each of the counties of the Western Coal Field from 1910 to 1920. The Western Coal Field as a whole in 1910 had 145.8 acres in woodland per square mile and 115.7 acres in 1920. Stated in terms of total acreage of woodland the Western Coal Field in 1910 had 707,796 acres and 561,431 acres in 1920 which was a decrease of 146,365 acres of woodland during the decade.

Much of the acreage cleared of forest occurs in the bottom lands along the streams and on the filled-in valleys of the uplands, but many acres thus deforested are on the steep slopes where the forests should have remained to protect the surface against erosion. Woodland cannot be decreased continually without finally reaching a time when there will be no more trees to cut off. The resulting loss of soil by erosion, especially on the bare slopes, will be severe; floods will occur with greater suddenness and force; smaller streams will go dry that have flowed during the drier months due to water seeping and flowing into them from the forests where it had been retained in times of rain and melting snow. Instead of cutting the forests from the steeper slopes trees should be planted until these slopes are sufficiently forested. They would then yield an income from their forest products. As it is, the slopes will ultimately become deforested and of little economic value.

Timber and Its Uses.

In pioneer days the Western Coal Field was covered with forests of beech, maple, sassafras, persimmon, hickory, walnut and the different varieties of oak. Today most of the valuable timber has been removed, although here and there trees of commercial size still stand and large logs at present are still being gotten out from these sections of the forested areas, as shown in Plates XVII and XLIX. The major part of the woodlands, however, is small, second growth timber and thickets. Large areas of hillside land have been cleared of forests, cultivated until the soil became exhausted of its fertility and then abandoned. Erosion has in many cases completed the ruin of the soil which man commenced to destroy when he cut away the trees. Additional causes for the decrease of valuable timber are forest fires; livestock grazing in the forests and injuring the trees, tending to make them decay low down on the trunk; cattle trampling and eating the seedlings and sprouts; too close grazing and trampling down of the soil causing the forest floor to become unsuitable for the retention of moisture and growth of seeds; diseased trees left standing after the healthy trees have been cut, thus allowing the diseases to remain, increase and spread to other trees in the forest.

The Western Coal Field is constantly being denuded of its forests as already described in considering unimproved land in woodlands. In 1910 there were 707,796 acres in woodland or 22.7 per cent of the total surface of the Western Coal Field; and in 1920, 561,431 acres or 18.0 per cent of the total land surface. The decrease in woodland from 1910 to 1920 was 146,365 acres. This was 20.6 per cent decrease in woodland since 1910.

In earlier days before the present development of railroad transportation, the logs were gotten to market by being floated loose or in rafts down the Rough River, Green River and other streams to the sawmills. At present portable sawmills in the forested areas cut the great logs into the desired dimensions, the rough lumber and other products being shipped out by rail to a great extent. This rough and semi-finished material is more easily transported and stored than the finished product such as doors, blinds, sashes and the like. Logs, however, are still rafted down some of the rivers. The Rough and Green Rivers meet at the town of Livermore where the manufacture of chairs is carried on. The location of this wood working industry is determined by its ready access to a supply of raw material, the logs being floated down these rivers to Livermore. A railroad also passes through the town giving it the added advantage of transportation by rail of raw and finished products. In some localities logs are hauled by team to sawmills located in nearby towns.

Near the markets for finished wood products are located the planing mills which use the rough and semi-finished lumber shipped them from the forests. Owensboro has several planing mills as mentioned in the description of that city in this report. In addition to the lumber from the Western Coal Field, these planing mills and the largest saw-mills have lumber shipped in to them from eastern Kentucky, Tennessee, and other forested areas of the Southern States. The location in Owensboro and Henderson of the manufacture of carriages and other products requiring a considerable amount of wood, necessitates good, economical, transportation by rail of the rough and semi-finished lumber from the forests to these cities.

Smaller trees are cut in great numbers for mine timbers and other purposes, Plate XVII. Railroad ties and other wood products are produced. Many of the smaller trees are cut and sold for firewood as well as being used by the owner.

If the Western Coal Field is to continue to derive an income from the sale of its forest products, it must commence to practice scientific forestry, to conserve and increase its forests. Where possible the steeper slopes should be left in forest. When the larger trees are cut, new trees should be planted to take their place. Trees might be planted in places which will bear a crop of commercially valuable nuts such as the hickory, chestnut, walnut and butternut. They would furnish the farmer with a cash crop and at the same time keep the land forested.

DRAINAGE.

Thousands of acres of land too damp for cultivation and in places swampy, occur adjacent to many of the streams in the Western Coal Field. The lower courses of the Green River and its chief tributaries have so slight a fall that they are not able to carry away the more rapid run-off from the hilly land to the

PLATE XVIII. DRAINAGE IN THE RIVER BOTTOMS.
Tributary ditch in central Muhlenberg County.

south and east. Back among the hills of the uplands material is being washed into the valleys from the higher lands faster than the streams can carry it away. The valleys which are thus being filled up are flat and comparatively wide. The drainage of the land is poor. The bottom lands along the rivers in the more rolling areas, are often broad and flat due to ponding of the streams with deposition in the flooded areas during past geologic times. Wash from the surrounding higher lands is continuing to fill up these valleys. Much of the bottom lands are covered with second growth timber. Only a few large trees are still standing. Poorly drained and swampy land occurs in the Ohio River bottoms. Sloughs and marshy land are found in long, narrow stretches, sometimes parallel to the Ohio River into which they cannot empty because of a higher strip of land along the river bank.

Large areas of swampy land have already been reclaimed. Each drainage project is usually under the control of a county drainage commissioner, although exceptions to this rule occur. An account of the laws governing drainage enterprises is given by the Fourteenth Census of the U. S. in the Bulletin on Drainage in Kentucky.

About two-thirds of the area in operating drainage enterprises in Kentucky, are in Daviess, Henderson and adjoining counties. The greatest amount of drainage has been performed in the regions near Owensboro and Henderson. Drainage projects have also been carried on in Hopkins, McLean, Ohio, Union, Webster and Muhlenberg counties. Outside of the Western Coal Field one-fourth of the area in operating drainage enterprises is in Jefferson County. Practically the entire balance is west of the Tennessee River (Ref: 11:4). The only operating drainage project in eastern Kentucky is one enterprise under private ownership in Lewis County.

Drainage of the land along the smaller streams is usually performed by deepening and straightening the channels, for the streams meander greatly as they flow slowly toward their temporary base-level. After this work has been completed the stream is able to hold and carry away the water that drains into it. The average maximum depth of outlet ditches in Daviess County is 12 feet; Hancock 10 feet; Henderson 14 feet; Hopkins 6 feet; McLean 8.5 feet; Ohio 6.0 feet; Union 14 feet; Webster 10 feet. Tributary ditches are dug leading into the main stream or ditch. The mean depth of these ditches in Daviess County is 3.9 feet; Hancock 6.8 feet; similar data for the other counties being given in Reference 11. Throughout the fields that are still in need of better drainage, tile is laid and smaller ditches constructed discharging into the larger tributary ditches, or into the main stream or central ditch, as shown in Plate XVIII. Many of the main streams acting as outlets for the drainage projects, discharge into the Green River or its tributaries.

The magnitude of the task involved in some of these drainage enterprises, is shown by the Panther Creek Drainage Project which was under construction in Daviess County in August, 1923. A steam shovel at work on this enterprise is shown in Plate XIX. Mr. R. H. Ford, Drainage Commissioner at Owensboro, Kentucky, kindly furnished the following data: The bottom lands of Panther Creek are subject to overflow with resulting damage to the crops. Other portions of the bottoms are swampy. In order to reclaim this land a $575,000 bond issue was authorized, of which $550,000 bearing six per cent interest were sold at par. Contracts for the project were let and the work commenced.

Thirty-five miles of drainage ditches are to be dug. They will form straight cuts at points where Panther Creek meanders. From the junction of the North and South Forks of Panther Creek to the end of the project, the new straightened stream channel will be only ten miles in length, where before the old stream was much longer. The top width of the new ditch in the North Fork will be from 28 to 60 feet, the average depth 11 feet. In the South Fork the top width will be from 56 to 90 feet at the forks. The average depth will be 13 feet. The main stream will be 124 to 136 feet wide and 14 feet deep, except along one stretch where the depth will be 34 feet. Sixteen steel bridges will be built at a cost of $80,000. A total of 55,500 acres of land will be reclaimed. The soil is rich and it is expected that large crops will be grown upon it.

Detailed data relative to drainage on farms and statistics concerning operating drainage enterprises for the counties of

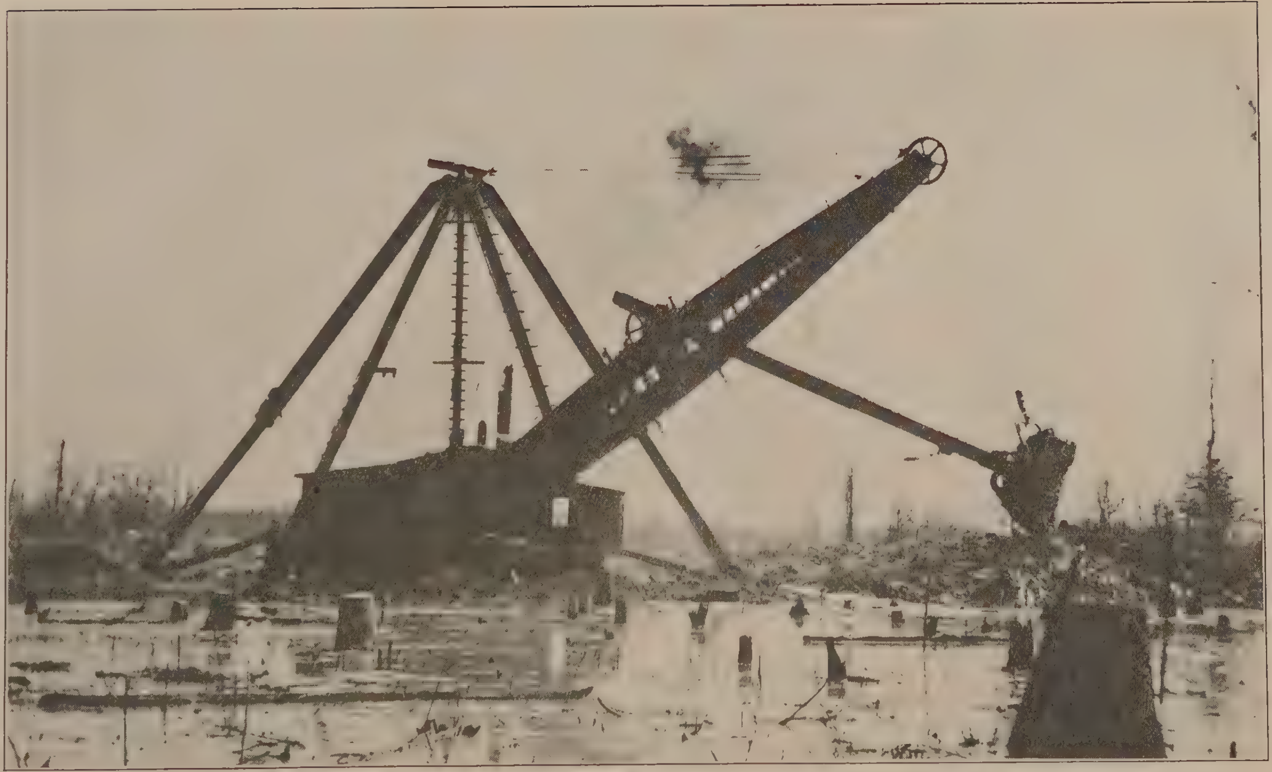

PLATE XIX. THE PANTHER CREEK DRAINAGE PROJECT.

Photo loaned by courtesy of R. H. Ford, County Drainage Commissioner, Daviess County, and C. A. Brown, Engineer, Panther Creek Drainage Project.

the Western Coal Field in which these works have been carried on are given in Reference 11.

Several large drainage projects are under construction or contemplated in McLean and other counties. The counties in which these enterprises are carried on, and the State as a whole, will be greatly enriched by this reclamation of the poorly drained areas of the Western Coal Field.

Improved Farm Land.

Improved farm land in the Western Coal Field in 1910 totaled 1,906,962 acres or 61.4 per cent of the total surface. In 1920 the improved land equaled 1,828,481 acres or 58.9 per cent. The decrease in improved land during this decade was 78,481 acres. In 1920, 54.3 per cent of the total land surface of the State was improved. Statistics relative to gain or loss of improved land by counties are given in Tables 10, 11, 12.

The per cent of the improved land in the counties of the Western Coal Field, is determined primarily by the topography as indicated in Table 11. The greater the area of level or gently rolling fertile soil, the higher the per cent of improved land, as in Daviess, Henderson and Union counties. In some of the counties swampy and wet soils have kept the per cent of improved land lower than it otherwise would be. Extensive drainage projects are under way or in process of organization in certain of these counties. For example, in Daviess County, the Panther Creek drainage project will reclaim a very large acreage, thereby adding greatly to the per cent of improved land in that county. In the moderately hilly regions where the valleys have been filled in with sediment washed from the surrounding uplands, the forests are often partly cut away. The flat field thus left is cultivated, while a fringe of forest borders the improved land on one or more sides. Thousands of acres have been cleared in the river bottoms but the flood-plains of many streams remain forested, either entirely or in part, with second growth timber amongst which are a few large trees. In the very hilly sections of the Western Coal Field the per cent of improved land is small. Thus Butler, Edmonson and the rougher surfaced counties have a lower per cent of improved land. Here and there the forests have been cleared from the slopes and corn and tobacco planted,

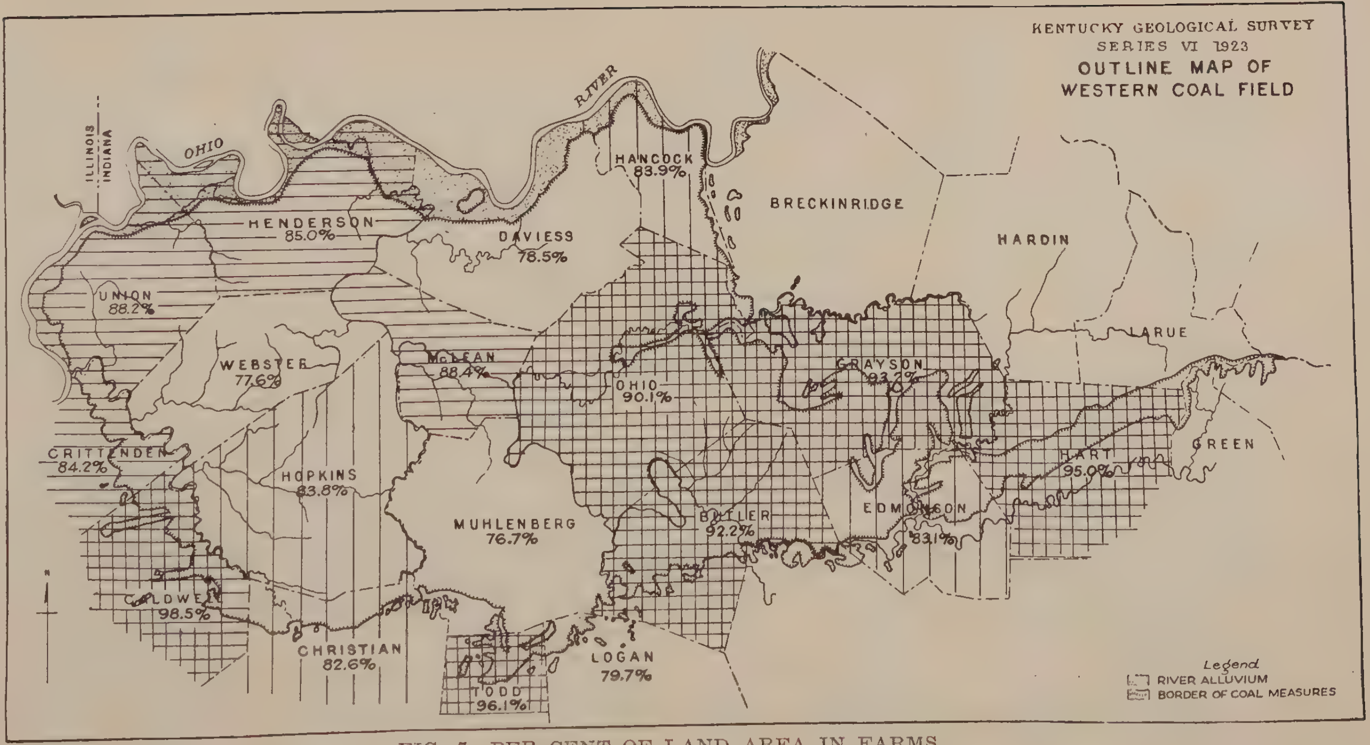

FIG. 7. PER CENT OF LAND AREA IN FARMS.

Explanation: Blank represents 75–80 per cent; vertical lines, 80–84 per cent; horizontal lines, 84–90 per cent; squares, over 90 per cent.

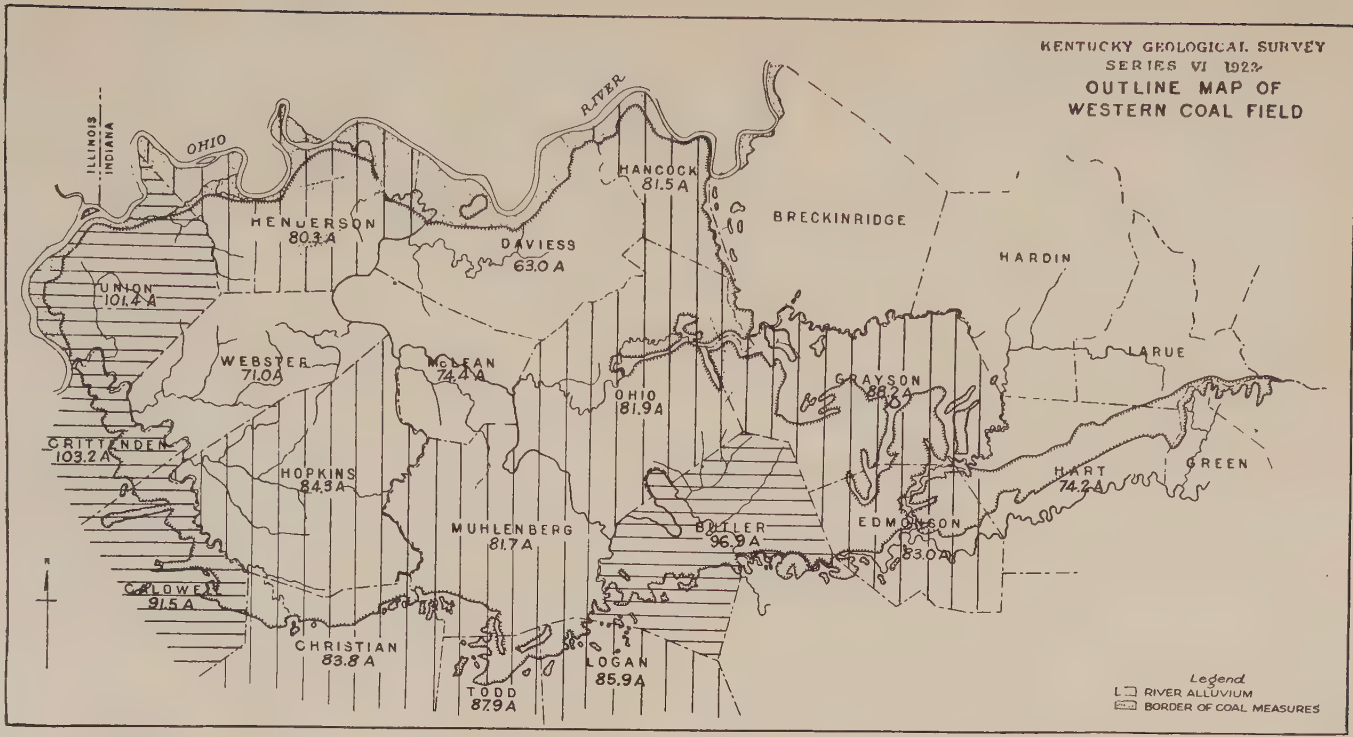

FIG. 8. AVERAGE SIZE OF FARMS IN ACRES.

Explanation: Blank represents 60-80 acres; vertical lines, 80-90 acres; horizontal lines, over 90 acres.

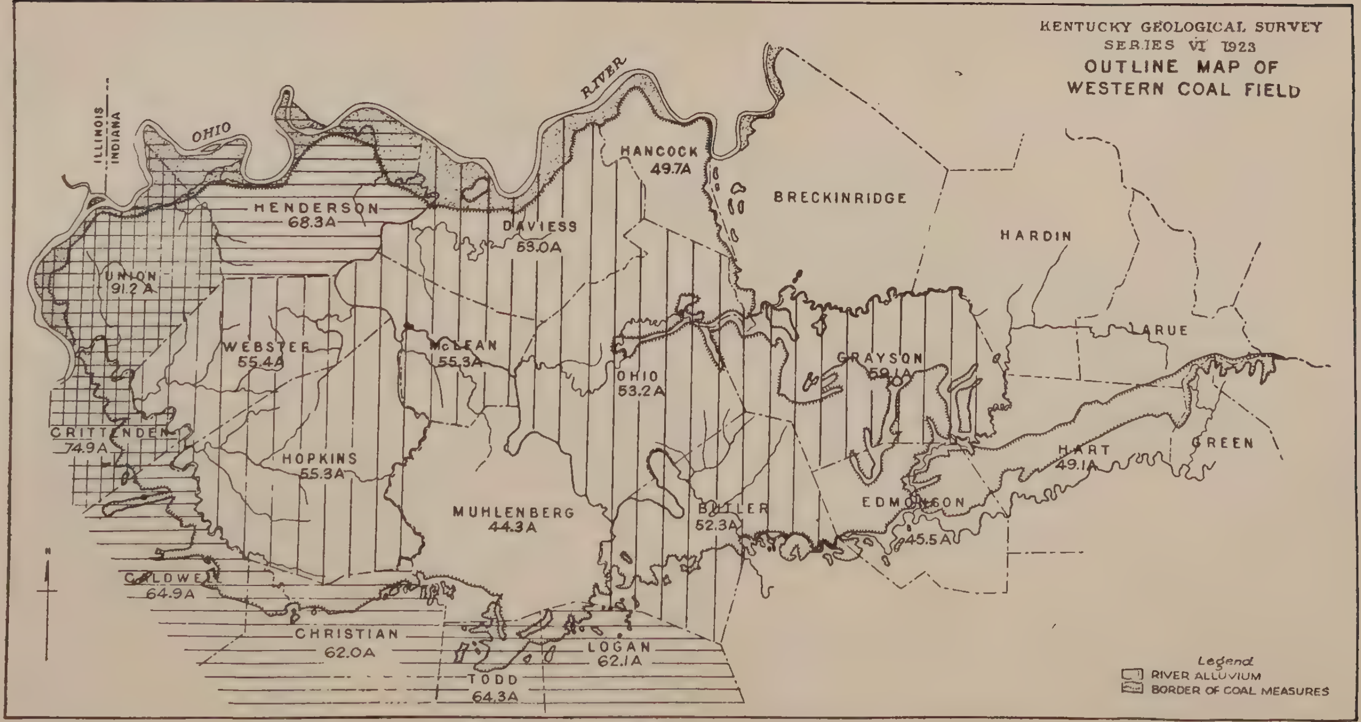

FIG. 9. IMPROVED LAND IN FARMS.

Average number of acres per farm. Explanation: Blank represents 40-50 acres; vertical lines, 50-60 acres; horizontal lines, 60-70 acres; squares, over 70 acres.

but these steep slopes wash easily and the improved land is ultimately worn out by overcropping and far too often completely ruined by surface wash. It is best to retain the forest on the steeper slopes. When possible the valley bottoms of the rough surfaced areas are often farmed.

The land in farms in the Western Coal Field increased 1.2 per cent from 1900 to 1910 and there was an increase of 2.4 per cent in the number of farms. The average number of acres per farm, Table 14, decreased from 88.2 to 87.2. The increase in the number of farms was due to increase of farm land and in part, to sub-division of the larger farms.

From 1910 to 1920, the land in farms decreased 4.1 per cent while the number of farms increased 2.5 per cent. The average size of each farm decreased from 87.2 to 81.4 acres. The increase in the number of farms was due to sub-division of the previously existing farms. The demand for farms was stimulated by the high prices of farm products during the World War. The market for farm products remained high into 1920 when a sudden decline took place.

Farms averaged a fewer total number of acres in the counties having a greater number of acres planted to tobacco per square mile of their area than in the counties where the tobacco industry is not so important. The reason is that tobacco which requires intensive cultivation, will yield, if the market is good, a return from a comparatively few acres, sufficient to support a family in the same degree of comfort that in general farming would require many more acres. Other conditions also influenced the size of farms but the tobacco growing industry played an important part.

The per cent of farm land improved in 1920 averaged highest in the more level counties as follows: Daviess 84.0 per cent; Henderson 85.1 per cent; McLean 74.2 per cent; Union 89.9 per cent; and Webster 78 per cent. In contrast Butler County had only 54.0 per cent of its farm land improved, Edmonson 54.8 per cent, Muhlenberg 54.2 per cent. Statistics for the remaining counties are given in Table 15. The Western Coal Field averaged 60.3 acres of improved land per farm in 1900 and 1910; and 56.3 acres in 1920. The State averages of improved land per farm for these years were 58.6, 55.4 and 51.6 acres.

Counties having a large acreage of level or gently rolling improved farm land, contained the greatest number of tractors. According to the Kentucky State Bureau of Agriculture (Ref: 16), Daviess County had 145 tractors in 1921, Henderson 200, and Union 175; whereas in contrast Edmonson had only 5 tractors.

The average value per acre of the Western Coal Field farm land, excluding buildings or improvements, in 1900 was $12.88; 1910, $20.21; 1920, $42.81. For these same years the value of farm land per acre throughout the State averaged $13.24, $21.83 and $48.62 respectively. The average per cents of increase in farm land values for these same decades in the Western Coal Field were 56 per cent from 1900 to 1910 and 111 per cent from 1910 to 1920. Farm land throughout the State averaged an increase in value of 64 per cent from 1900 to 1910 and 122 per cent from 1910 to 1920.

A study of land values in the individual counties of the Western Coal Field shows that the level and rolling counties with better soils, good transportation facilities and ready access to market, had in 1920, the highest average farm land values Daviess County farm land averaged $92.21 per acre; Henderson $79.14; and Union $85.35. The hilly counties with average poorer soils, difficulties in farming and in reaching a market, had much lower land values than the counties just mentioned. Butler County averaged $15.84 per acre and Edmonson $14.76. Statistices on farm land values for the other counties are given in Table 16. There is also a relation between the valuation of farm land per acre and the per cent of farm land improved, as shown in Tables 15 and 16. Butler County, for example, with 54 per cent of its farm land improved in 1920, had an average valuation of $15.84 per acre, whereas Daviess County with 84 per cent of its farm land improved, had an average farm land valuation of $92.21 per acre.

The greatest per cent of increase in farm land values during 1900-1910 occurred in Hopkins County, where the increase was 100 per cent. From 1910 to 1920 the greatest increase in farm land values was 143 per cent which occurred in Ohio

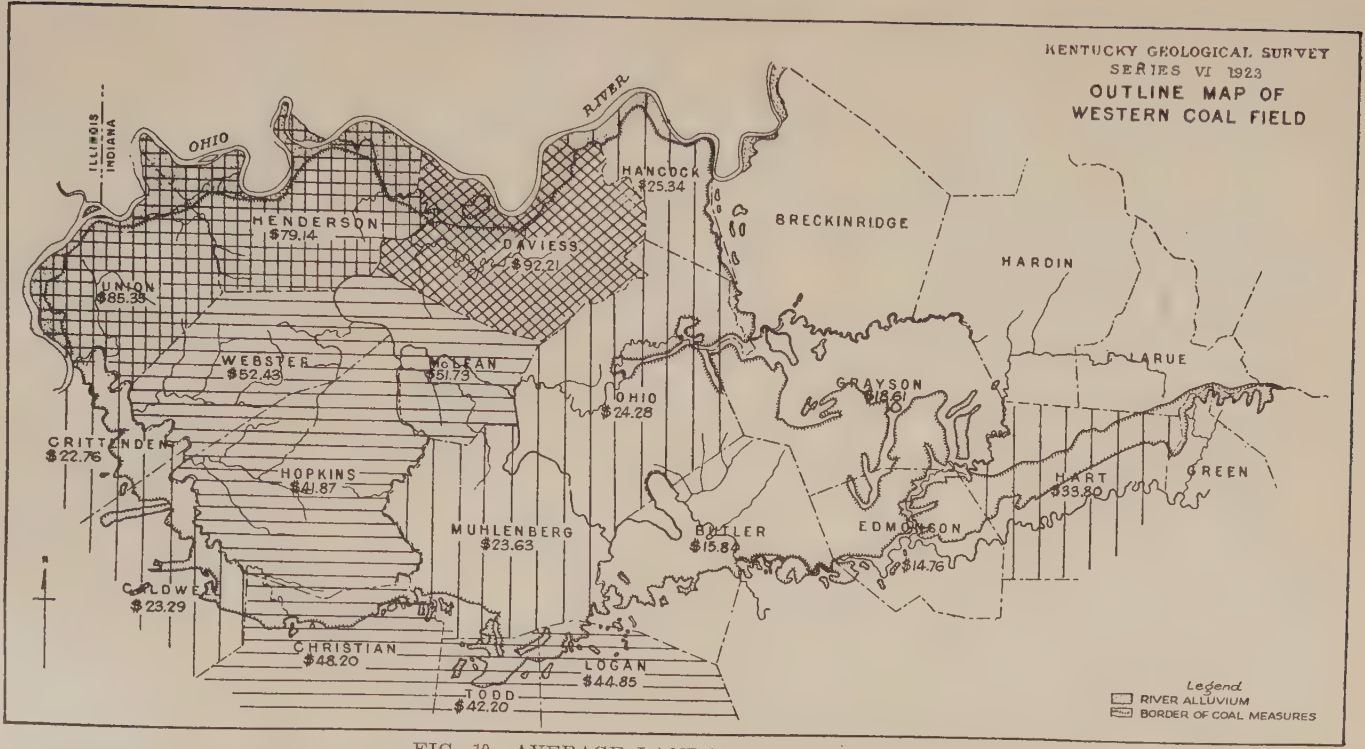

FIG. 10. AVERAGE LAND VALUE PER ACRE.

Explanation: Blank represents $10.00–$20.00; vertical lines, $20.00–$40.00; horizontal lines, $40.00–$75.00; squares, $75.00–$90.00; diamond shape, over $90.00.

County. Table 16 gives the per cent of increase in farm land values by decades for each of the Western Coal Field counties. In the more rugged and less developed counties the per cent of increase in valuation has been high, but the actual increase in valuation per farm acre has been a fewer number of dollars than in the more level counties.

Important causes for the average increase in farm land values are the many large and small drainage projects that have been carried to completion during the past years. The several great drainage projects at present under way, will further increase the average value of farm land in the counties in which ditches are being dug. As time goes on, the wide areas as yet unreclaimed should be reclaimed when economically possible, thereby adding to the valuation of the farm land in the county and increasing the wealth of the State.

The higher farm land prices which were prevalent toward the close of the decade ending in 1920, declined when the selling prices of farm products started their downward plunge in 1920. For example, Daviess County farm land in 1920 sold at an estimated average maximum of $180.00 per acre, in 1921, $100.00 per acre. Henderson County farm land declined in price from a maximum of $300.00 per acre in 1920 to a maximum of $150.00 in 1921. The more rugged and remote counties which did not produce much tobacco, did not have as great a decline in the maximum selling price of the land. Butler County farm land in 1920, sold at an estimated maximum of $100.00 per acre and in 1921, $87.00 per acre. Edmonson County farm land declined from a maximum of $60.00 per acre in 1920 to $50.00 in 1921. (Ref. 16: 148-150).

The topography, soils and transportation facilities influence directly the average assessed value of all property per farm. The level and gently rolling counties have the highest valuation for all property per farm while the remote, rugged counties have the lowest. Union County in 1920 ranked first, the average assessed value of all property per farm being $12,003; Henderson $8,678; Daviess $8,028, whereas Butler averaged $2,626 and Edmonson $2,144. Table 17 gives similar statistics for the remaining counties. The average value of all property per farm in the Western Coal Field was $2,817 in 1910 and $5,111 in 1920 as compared to the State average of $2.986 and $5,587 for the corresponding years.

The gross crop returns for the Western Coal Field farms show that this source of farm income bears a relation to topography and the per cent of improved acreage. Counties having the more level farming areas and greater per cent of improved land, had a larger average income per farm than those where farming conditions are not so favorable and the per cent of improved land is smaller. In 1919 the largest average gross crop returns per farm were secured in Union County where this source of farm income was $2,756.05. Henderson County came second with an average of $2,245.36 and Daviess County third with $2,166.81 gross crop returns per farm. Butler County's average gross crop return per farm was $922.02, Edmonson $806.79 and Grayson $802.64. Table 17 gives similar data for all of the Western Coal Field counties.

The Western Coal Field as a whole, in 1909 averaged $565.40 gross crop returns per farm and $1.512.52 in 1919, as against the State average of $536.19 and $1.288.33 for the corresponding years. The increase in crop incomes from 1909 to 1919 was due to the rise in the selling price of farm products. The period of depression that commenced for farmers in 1920 with the decline of price of farm products, greatly lowered average farm incomes.

CROP PRODUCTION.

Corn, wheat and tobacco are the chief crops grown in the Western Coal Field. A comparatively small acreage is devoted to oats, rye and barley. Forage crops are grown in all of the counties. Sorghum is planted most extensively in the rougher surfaced counties and those having poor railroad facilities. Apples, peaches, pears, plums, cherries, grapes, strawberries, and blackberries are more or less important in various sections.

CEREALS.

The Western Coal Field lies within the corn belt of the United States and corn is the staple crop. Even in the marshy bottom lands fields occur where the forests have been cut away, and the land has been drained and planted to corn. In the rougher surfaced districts clearings are seen where small patches of corn grow, bordered by forests.

In 1919 over 79 per cent of the land in the Western Coal Field devoted to cereals, was planted to corn. Of the total cereal production measured in bushels that same year 85 per cent was corn.

Climate has an important influence upon the acreage planted to corn. A comparison of the climate of the Western Coal Field with that of the greatest corn producing States is as follows: In the great corn producing regions of the United States the mean summer temperature is from 70 to 80 degrees; the average daily minimum temperature in summer is over 58 degrees; the average frostless season is over 140 days; the annual precipitation is between 25 and 50 inches; the precipitation of July and August totals from 7 to 8 inches. The most critical period as regards precipitation, which is the important climatic factor in determining the yield of corn, is from the middle of July to the middle of August. The most important calendar month, according to J. Warren Smith, is July. The average rainfall for July over the corn belt for 28 years was 3.9 inches. Prof. J. W. Smith (Ref. 79:153), states: "If the years of different rainfall amounts are grouped together, it will be found that whenever the rainfall has been one-halt inch or more above the normal, the yield of corn has averaged 10 bushels to the acre

PLATE XX. GENTLY ROLLING LAND IN NORTHERN DAVIESS COUNTY.

more than when the rainfall has been one-half inch or more below the normal ''

The climate of the Western Coal Field falls well within the necessary climatic requirements given above. The mean summer temperature of the Western Coal Field is 75.9 degrees; average daily minimum summer temperature 64.6 degrees; average frostless season over 165 days, and the probable length of the growing season 4 out of 5 years is from 179 to 201 days; annual mean precipitation 45.15 inches; rainfall in June 3.49 inches, July 4.11 inches, August 3.39 inches; precipitation for July and August totals 7.50 inches. The July precipitation of 4.11 inches was above the average for the corn belt of the United States which was 3.9 inches.

Thus poor yields of corn in the Western Coal Field are not caused usually by climatic conditions but on the average are the result of infertile or poorly drained soils, lack of cultivation or other detrimental factors which often can be remedied by scientific farm practice.

The topography and soils play an important part in the production of corn with the following results. The greatest yield per square mile occurs in those counties which have the largest area of level or gently rolling surface that, where necessary, has been drained and cultivated. On the other hand, the rougher surfaced areas and swampy bottom lands produce much smaller yields of corn. Examples of these physiographic influences upon the yield of corn in 1919 are as follows: Union County, which has a gently rolling topography over wide areas within its boundaries planted 157.7 acres to corn per square mile of land surface, the yield being 4,385.6 bushels. Henderson County which also has a great deal of flat and gently rolling surface, had 154.2 acres in corn per square mile, with a yield of 3,636.0 bushels. Counties having a rougher topography did not produce as much corn per square mile as the more level counties. Thus Muhlenberg County planted 73.9 acres to corn per square mile, the yield being 1,349.9 bushels. Several counties, whose surfaces are of moderate relief, contain large areas of swampy bottom lands at present covered with second growth timber. And even when the forests are cut away the land is often too wet to cultivate. Extension drainage projects now

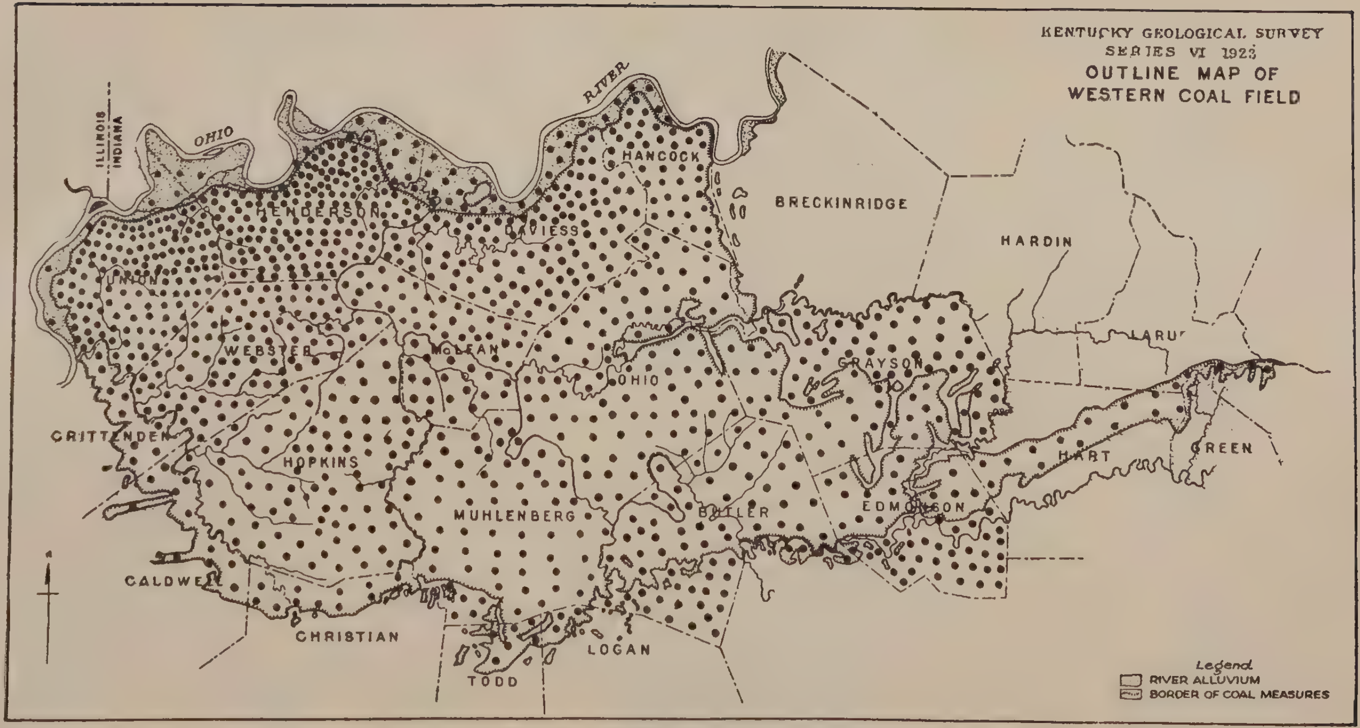

FIG. 11. DISTRIBUTION OF CORN.
Explanation: Each dot represents 10,000 bushels.

under way will reclaim thousands of acres of land which will yield corn abundantly. The average yield of corn per square mile of territory in these counties therefore will greatly increase as time goes on. Large tracts of upland in various counties are kept in forests by the coal companies which own the land. The timber is to be used for mining purposes.

The topography also influences the economical production of corn enabling corn to be produced on a commercial scale more cheaply per bushel in the level areas as compared to the hilly regions. In the level or gently undulating areas the yield per acre is good and one man can farm many acres with machinery. Corn also is fed to the live stock in these richer farming districts where the fattening of swine is an important industry. In the hilly districts corn is grown because it requires only a few, inexpensive tools. The steeper slopes make farming with machinery, other than the most simple kinds, unadvisable. Corn yields more per acre than the other small cereals. It yields comparatively well, even when poorly cared for. It can be stored readily. It is fed to the farm animals and in the form of meat on the hoof can be driven to market over rough, narrow dirt roads. Corn also enters into the production of other animal products which are of a higher value per pound than the corn. These animal products can be gotten to market far more economically than the bulky, cheaper corn. The corn is taken to the local mill and ground into meal. It is then used as food by the entire family.

The yields of corn in the Western Coal Field compared to the State average since 1909 were as follows: In 1909 the average number of bushels per acre equalled 22.1; in 1919, 20.3. The State average yield of corn per acre in 1909 was 24.25 bushels; in 1919, 22.02 bushels. Thus the Western Coal Field in 1919 produced 1.8 less bushels of corn per acre than in 1909. The State yield was 2.23 bushels less per acre in 1919 than in 1909. The Western Coal Field in 1909 produced 2,589.3 bushels, and in 1919, 2,140.5 bushels of corn per square mile of total land surface. The State produced in 1909 an average of 2,074 bushels of corn, and in 1919, 1,779 bushels per square mile of total land surface. Thus in 1909, the Western Coal Field produced 515.3 bushels of corn per square mile more than the State average;

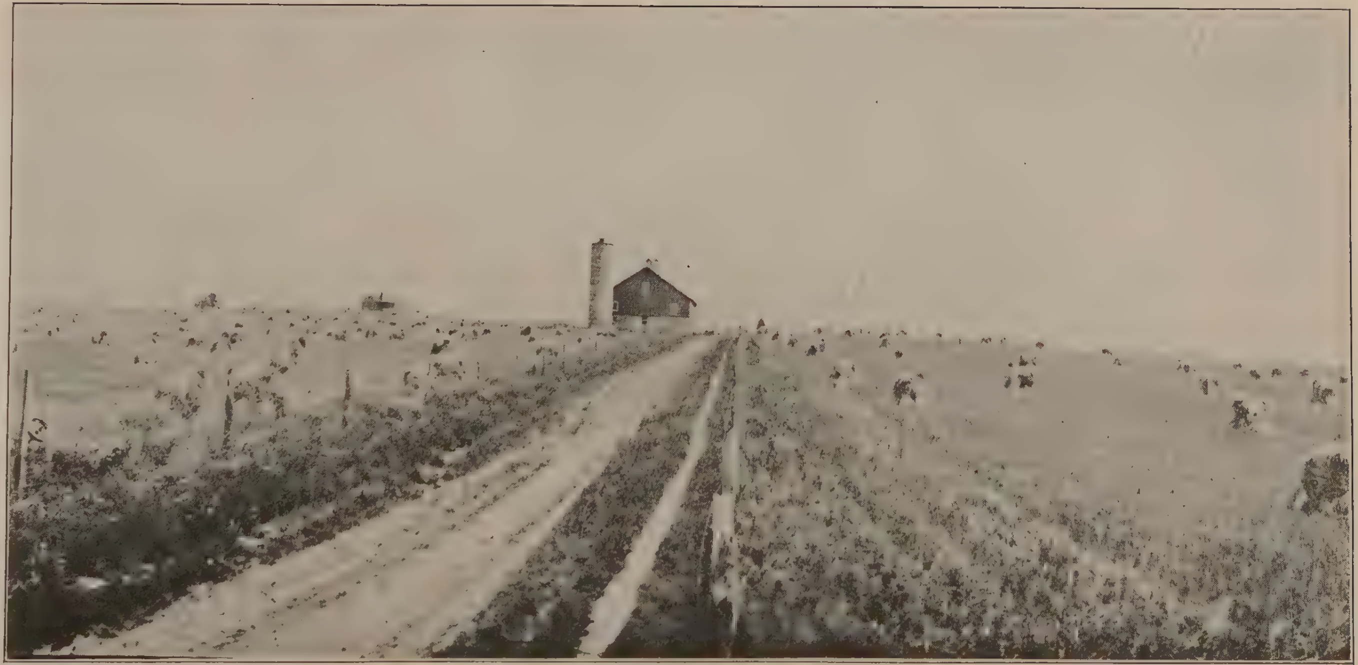

PLATE XXI. A WHEAT FIELD ON THE OHIO RIVER PLAIN, HENDERSON COUNTY.
Photo furnished by courtesy of the Henderson Chamber of Commerce.

and in 1919, the Western Coal Field averaged 361.5 bushels of corn per square mile more than the State average. This large average yield of corn per square mile in the Western Coal Field was due to the production secured from the level and gently rolling lands.

The production of corn per square mile of improved land surface in the Western Coal Field, and the State, is shown in Table 18.

Wheat production in the Western Coal Field is influenced by the topography. The greatest acreage planted to wheat per square mile occurs in those counties having the largest areas of level or gently rolling, tillable land. On this type of topography machinery can be used to advantage. In the rough surfaced areas farm machinery cannot readily be used, more hand labor is required, and the cultivated portions of the farms are smaller than in the more level regions. Corn is raised in preference to wheat in these more rugged districts. Examples are as follows: Union County, with its broad expanses of gently undulating land in 1919 planted 53.3 acres to wheat per square mile of total land surface, the yield being 801.2 bushels. Production per square mile of improved land surface in Union County in 1919 was 1,010.5 bushels. Daviess County, with wide areas of level and gently rolling surface, in 1919 ranked second with 36.8 acres in wheat per square mile of total land surface, the yield being 643.2 bushels. Production per square mile of improved land was 975.8 bushels. Henderson County which also has a large acreage of flat and rolling land had 33.6 acres in wheat per square mile of total area, Plate XXI. The yield was 494.9 bushels per square mile of total surface, and 684.3 bushels per square mile of improved land. These three counties produced large average yields of wheat per square mile of total and of improved surface due to their great expanses of level and undulating land even though they contain more hilly or swampy areas within their borders which tended to reduce the general average yield of wheat per square mile.

In contrast to the production of wheat in the more level surfaced counties cited above, Edmonson County with its hilly section in 1919 planted 7.1 acres of wheat per square mile, with a yield of 61.7 bushels per square mile of total land surface, and

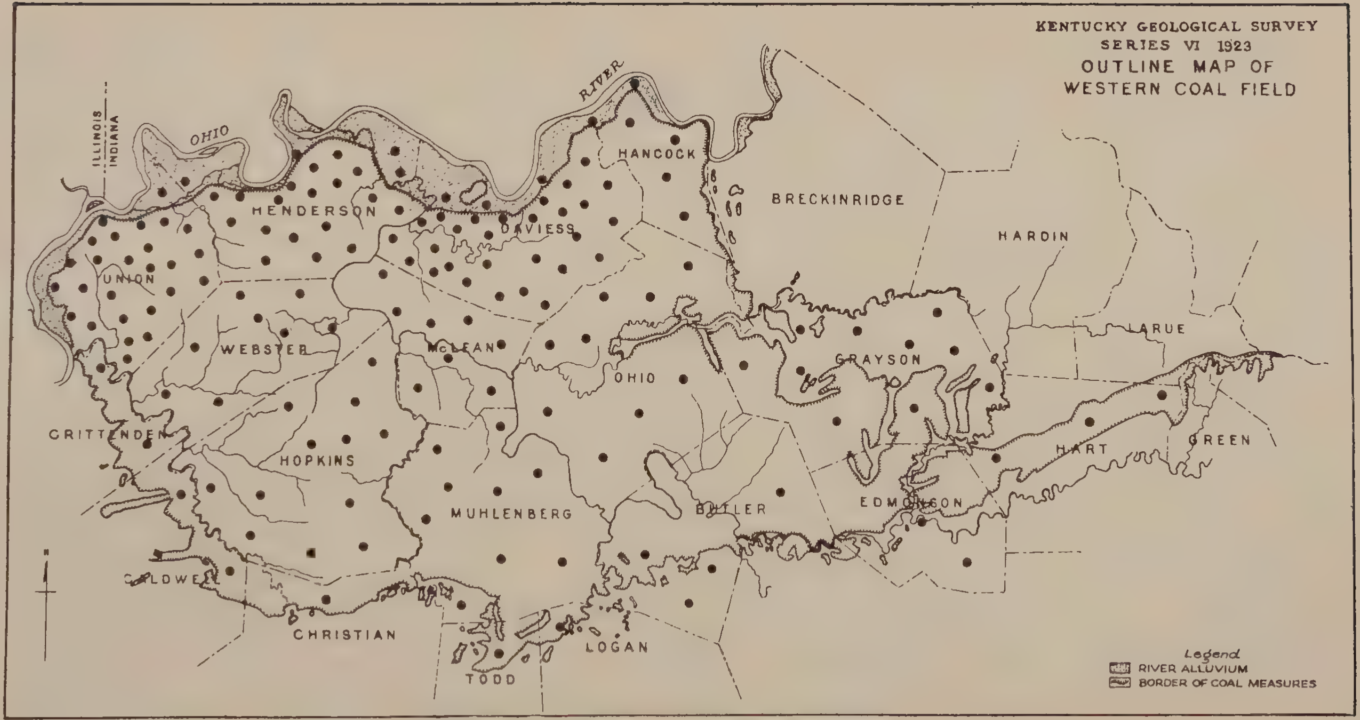

FIG. 12. DISTRIBUTION OF WHEAT.
Explanation: Each dot represents 10,000 bushels.

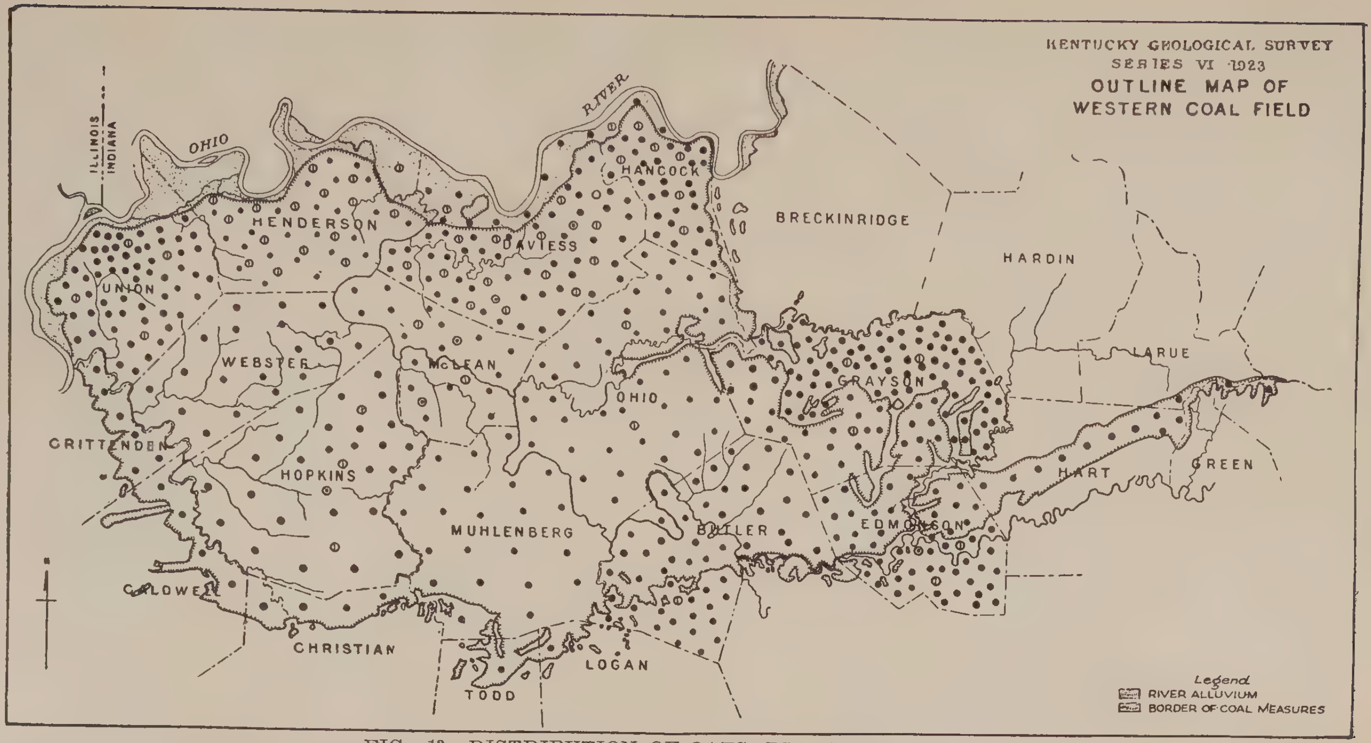

FIG. 13. DISTRIBUTION OF OATS, RYE AND BARLEY.

Explanation: Each dot represents 500 bushels of oats; circle with bar, 100 bushels of rye; dot in circle, 100 bushels of barley.

135.6 bushels per square mile of improved surface. Table 19 shows the same physiographic control over the production of wheat to occur in the remaining counties of the Western Coal Field. In the Western Coal Field as a whole, the average yield of wheat per acre in 1909 was 15.1 bushels; and in 1919, 13.4 bushels. The average yield of wheat per acre for the State in 1909 was 12.8 bushels; in 1919, 12.3 bushels.

Oats in 1919 ranked third among the cereals produced in the Western Coal Field, 4.1 acres being planted per square mile of total land surface, and 52.6 bushels produced from this acreage. The average yield of oats per acre was 12.6 bushels. Production of oats by counties is shown in Fig. 13.

During this same year of 1919, the State averaged 5.7 acres to oats per square mile with a yield of 69.4 bushels. The State average yield per acre was 12.1 bushels of oats.

Thus it is seen that oats are not an especially important crop in the Western Coal Field. They are grown chiefly for use on the farm where they take their place in the crop rotation.

Rye and barley are grown sparingly in the Western Coal Field. Only 0.15 acres of rye per square mile of total surface were planted in 1919, the yield being 1.1 bushels. Compare this acreage with the State average of 0.68 acres in rye per square mile, and a yield of 5.9 bushels. Rye could be used advantageously in many places in the Western Coal Field as a cover crop and later plowed under. It thus would aid in preventing soil erosion and would enrich the soil.

Barley averaged 0.014 acres per square mile in the Western Coal Field in 1919, the yield being 0.13 bushels. The State average in 1919 was 0.139 acres per square mile with a yield of 2.97 bushels.

Buckwheat is seldom produced in the Western Coal Field.

The acreage and yield of edible beans and dry peas per square mile are given in Table 23. The production of these crops is small.

Hay and Forage Crops.

Hay and forage crops covered 13 per cent of the cropped area of the Western Coal Field in 1919. About 58 per cent of this acreage was timothy, sweet and red clover, alfalfa and other tame or cultivated grasses. The remaining 42 per cent stated in order of acreage consisted of corn cut for forage; small grains cut for hay; annual legumes cut for hay; wild, salt or prairie grasses; silage crops; kafir corn, sorghum, etc., for forage; root crops for forage.

Timothy, clover, alfalfa and other tame grasses in 1919 composed 63.9 per cent of the tonnage of the hay and forage crop. The level or rolling counties produced the greater amount of this tonnage of tame grasses per square mile of area. For example Union County in 1919 had 44.0 acres in cultivated or tame grasses per square mile, with a yield of 65.1 tons. Daviess County had 46.3 acres producing 61.6 tons of tame grasses per square mile. The more hilly counties showed the following results: Butler County 20.7 acres in tame grasses yielding 20.2 tons; Edmonson County 8.7 acres, 8.9 tons; Grayson County 13.5 acres, 12.6 tons; Muhlenberg County 24.1 acres, 23.8 tons. Many of the hillsides are in pasture, which is a practice that should be followed more extensively on the slopes that have been cleared of their timber. Fields that have been left bare after the forests were cut away, or on being abandoned after continuous cropping become badly gullied.

Clover is planted mostly in the more level areas of the counties mentioned above as leading in cultivated grasses. Thus Daviess County, for example, had 12.2 acres in clover yielding 17.2 tons per square mile, whereas the rougher surfaced Edmonson County had only 1.1 acres yielding 1.2 tons per square mile. Similar results in acreage and tonnage of clover for the other counties are shown in Table 20. The acreage and tonnage of hay and forage crops in the Western Coal Field, and State as a whole in 1919 are given in Table 20. The greater acreage and tonnage of tame grasses per square mile in the Western Coal Field as compared to the State average was due to the level and gently rolling areas of Daviess, Union and other counties.

Sorghum is grown in greater amounts in the more isolated portions of the Western Coal Field than in the areas nearer to transportation lines. The reason is that in the more remote regions the people endeavor to produce more of their own food than in the districts within economical reach of the railroads where goods can easily be obtained from the outside world.

Sorghum canes are cut for feed for the animals, and the seed is fed to the poultry, cows and pigs. Hancock County, with a railroad only along its most northern border, ranked first in 1919 among the Western Coal Field counties in acreage and tonnage of sorghum grown for sirup per square mile of territory. It had 2.15 acres per square mile with a yield of 14.7 tons and 185.6 gallons of sirup. Butler County, which has no railroads, planted 1.82 acres in sorghum per square mile, production being 5.10 tons and 56.1 gallons of sirup. Counties well served with railroads planted smaller acreages to sorghum per square mile of area. Henderson County had in 1919, 0.43 acres in sorghum with a yield of 1.6 tons and 15.7 gallons per square mile; Union County planted 0.18 acres to sorghum, producing 0.64 tons and 9.0 gallons. The same influence of railroad facilities upon the production of sorghum holds true for the other counties of the Western Coal Field as shown in Table 23.

TOBACCO.

Tobacco is an important cash crop in the Western Coal Field. A typical tobacco patch is shown in Plate XXII.

Tobacco was introduced into Kentucky to a marked extent at the close of the Revolutionary War by pioneers from Virginia and Maryland. They had raised this weed in their home states and therefore planted it on their new land holdings. Soil is an especially important factor in the successful production of tobacco, and as large areas in Western Kentucky possessed

PLATE XXII. FARM SCENE, NORTHERN HENDERSON COUNTY.

the necessary soil requirements and favorable climate, the industry developed rapidly. Much of the tobacco was shipped down the Ohio and Mississippi Rivers to New Orleans from which city it was exported to the markets of Europe. By 1840 Kentucky ranked second to Virginia in the production of tobacco. During the Civil War the tobacco industry in Virginia almost ceased and Kentucky passed Virginia as a tobacco producing State.

Dark tobacco is raised in the several tobacco districts of the Western Coal Field. The dark-fired type of tobacco was grown extensively for export in the early days and is still produced for this purpose. It was discovered that tobacco cured by open fires kept better, especially during the ocean journey to Europe. Also the rankness was modified "and the quality improved by the heat used and the cressotic flavor imparted, (Ref. 55:29). The habit of using this heavy, fire cured tobacco of smoky flavor, therefore, became firmly fixed in a number of the nations of Europe which used American tobacco. Habit is everything in the use of tobacco and the tobacco user desires what he has been in the habit of having."

The soils upon which this dark tobacco is grown are strong and durable with a considerable clay content. The subsoil is clay.

There are three main divisions of the western dark-fired tobacco as follows: (1) The Clarksville and Hopkinsville district whose northern boundary extends through the southern portions of Muhlenberg and Hopkins counties and continues in a slightly southwesterly direction to the Tennessee River; (2) the Paducah or Western district which lies outside the Coal Field; (3) the Henderson or Stemming district which covers approximately the western half of the Coal Field. The eastern portion of the Coal Field includes the Green River District where an air cured, dark tobacco is grown. The One-Sucker type of air cured dark tobacco is produced in the southeastern border counties of the Coal Field and to the southward. Having no smoky flavor and odor they are used for domestic manufacture and consumption, and are also exported.

The production of tobacco per square mile in the various counties of the Western Coal Field is given in Tables 21, 23.

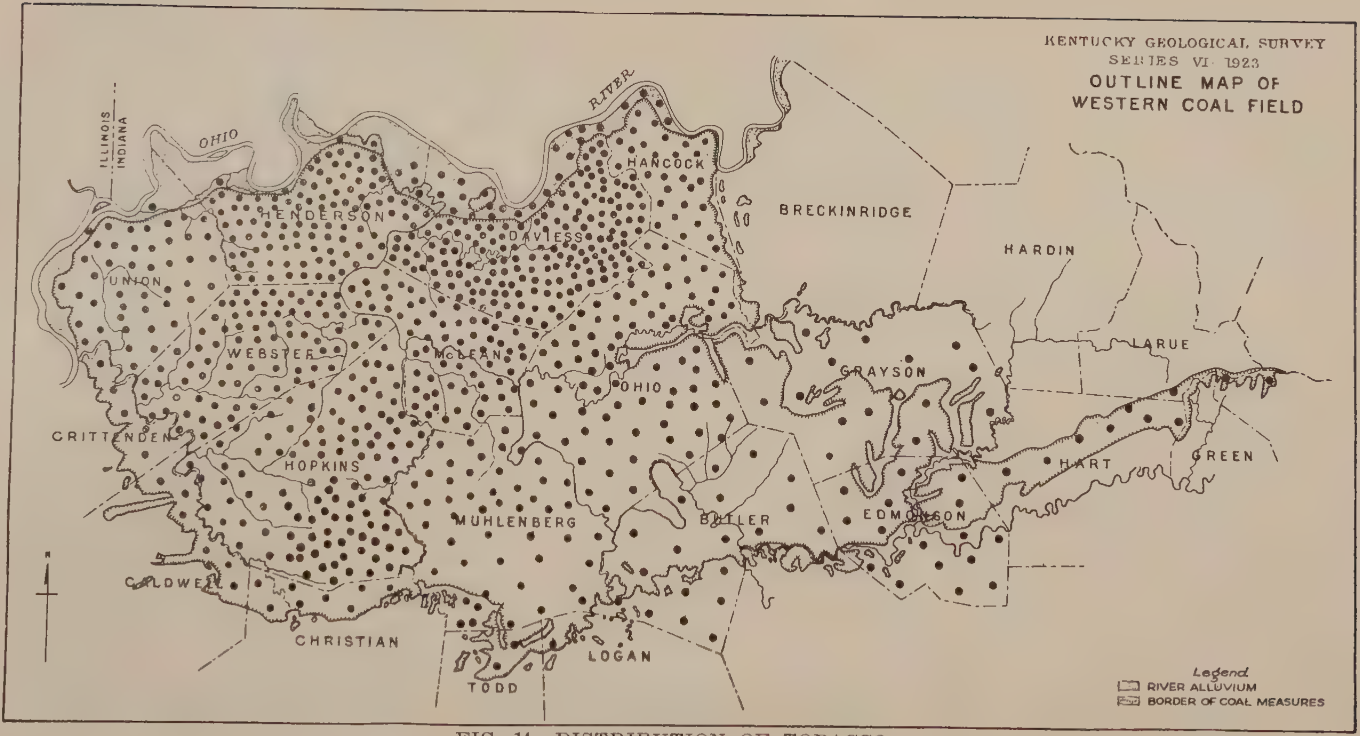

FIG. 14. DISTRIBUTION OF TOBACCO.
Explanation: Each dot represents 100,000 pounds of tobacco.

Among the most important in 1919, was Daviess County which had 37.3 acres in tobacco with a yield of 36,595.9 pounds per square mile. Henderson County had 32.9 acres in tobacco with a yield of 23,866.5 pounds per square mile.

The average yield of tobacco per acre in the Western Coal Field in 1909 was 762.3 pounds; in 1919, 798.4 pounds.

Tobacco is produced with much intensive hand labor. It furnishes quite steady employment throughout the year. If the tobacco patch is fairly large, the work is usually performed by the entire family. On some farms outside help is employed, but farm labor is difficult to secure. Hence the women and children often work in the tobacco patch when the farmer would prefer to use hired help. The fire cured dark tobacco on being cut is suspended in a barn and a smoky fire is kindled beneath it. The smoke and heat rise through the tobacco and cure it. In August and September one often sees an unpainted, weather-beaten barn with gray smoke issuing lazily from the roof and upper portions of the walls.

Tobacco exhausts the soil and should be raised in rotation with other crops. This method is employed on many farms, but some farmers do not practice correct methods with the result that the soil fertility is depleted and on the slopes erosion completes the ruining of the field.

The average cost of producing dark tobacco is given in Table 22.

Marketing the tobacco is a very important item to the farmer. The dark-fired type is chiefly exported to Great Britian, Italy, Germany, France, Spain, Austria and Belgium in the order named as regards the quantity shipped abroad (Ref. 55:34, 37). The United Kingdom is the greatest single purchaser of this type of tobacco, securing the largest quantity of its supply from the Henderson or Stemming district. The name Stemming was originally applied because so much of this tobacco was stemmed before being shipped to Great Britian. Henderson City is the most important market in the Stemming district. Other tobacco markets are Providence, Madisonville, Princeton and Nebo.

Many of the farmers have united and formed a marketing organization of their own, known as the Dark Tobacco Growers' Association.

A coarse, long, dark tobacco is tied in small bundles, specially prepared, and exported to Africa where it is sold at retail to the natives. Similar tobacco is shipped to the West Indies, Mexico, and Central and South American countries. Tobacco for this trade is also obtained from the One-Sucker district.

The dark-fired tobacco is not extensively used in the United States. A considerable quantity is used, however, as snuff. Some wrappers for domestic plug are made from this type of tobacco and a portion is used in the manufacture of cheap cigars for the Italian population of New York City.

The air cured dark tobacco of the Green River district has no odor and flavor of smoke. The most important local market is Owensboro. Other receiving points are Fordville, Hawesville, Hartford, Hardinsburg and Livermore. The large portion consumed in the United States, is used chiefly in the manufacture of long cut smoking tobacco. Some of the finer grades are made into fine-cut chewing tobacco. It is also exported principally to Great Britian (Ref. 55:86, 87).

The One-Sucker type of dark tobacco is air cured and therefore has no smokey odor or flavor. It is consumed in the United States and also exported. When grown on rich land its leaf is long and heavy and it is exported chiefly to the west coast of Africa.

The prices received by the farmers for their tobacco throughout the Western Coal Field have varied from year to year, but with proper grading and marketing the growers should fare better than in the past.

POTATOES.

Irish or white potatoes are raised quite uniformly in all of the counties of the Western Coal Field. The average acreage per square mile planted to white potatoes in 1919 was 0.46 acres, the yield being 25.5 bushels. The State that same year averaged 1.24 acres in potatoes per square mile with a yield of 77.9 bushels. The higher State average was due to the great development of the potato industry in the vicinity of Louisville.

Production of potatoes can doubtless be increased in those sections of the Western Coal Field which have nearby cities offering good local markets, and adequate transportation by rail to more distant markets outside of the Coal Field. Daviess County, in which is situated the city of Owensboro, in 1919 ranked first in acreage and production of Irish potatoes per square mile of territory. There was planted 0.66 acres to potatoes per square mile with a yield of 37.5 bushels.

Production of sweet potatoes and yams is given in Table 23.

MARKET GARDENING.

Truck gardening is most highly developed near to good local markets. Daviess County which contains the city of Owensboro, in 1919 ranked first in acreage planted to vegetables other than Irish and sweet potatoes, having 1.37 acres in vegetables per square mile. Counties having only small towns or cities and no nearby markets outside of their own area which could readily absorb more than their own county produced, were of small importance in the market gardening industry. Thus Butler County in 1919 had only 0.033 acres in vegetables per square mile; Edmonson, 0.025 acres; Grayson, 0.028 acres; Ohio, 0.039 acres, and Union, 0.024 acres. The average for the Western Coal Field as a whole in 1919 was 0.342 acres in vegetables per square mile, while the State averaged 0.401 acres in vegetables. The higher State average of vegetables planted per square mile was largely due to the great development of the market gardening industry near Louisville.

FRUITS.

The production of fruits may be divided into the culture of (1) small fruits, (2) orchard fruits.

The small fruits include strawberries, blackberries and dewberries. They are grown in all of the counties of the Western Coal Field, but the average production of small fruits per square mile (Table 23) is considerably less than the State average production. In 1919, the Western Coal Field averaged 0.028 acres of strawberries with a yield of 21.79 quarts per square mile. Blackberries and dewberries averaged 0.038 acres with a yield of 28.7 quarts per square mile. The State average per square mile was 0.077 acres of strawberries producing 79.50 quarts, and 0.06 acres of blackberries and dewberries yielding 44.2 quarts. The higher State average for small fruits as compared to the Western Coal Field was due in great part to the importance of small fruit culture in Jefferson County near to the city of Louisville. In the Western Coal Field an expansion of the small fruit industry should be possible near to the larger cities such as Owensboro. But before commencing the culture of small fruits on a large scale, one should be certain that he can obtain sufficient labor at picking time, and that transportation facilities to market are such that the fresh fruit can be delivered to the buyer in good condition and cheaply enough to insure the grower a fair profit. The market should be large enough to take all of the fruit offered without unduly depressing the price.

The more universal production of fruits on a small scale for home use will be of benefit to the inhabitants of the Western Coal Field. The homes thus would be supplied with fresh fruit in season, and the various fruits grown could also be preserved in sufficient quantity to form part of the diet during periods of the year when fresh fruits are not obtainable. Many families already follow this plan using cultivated and wild berries.

Orchard fruits include apples, peaches, pears, plums, and cherries. The climate of the Western Coal Field is suitable for the production of these fruits. Killing frosts, however, may occur. The hills give an air drainage and thus tend to aid the orchards planted higher up the slopes against being damaged by frosts. Heating of the orchards and other methods of protecting the buds will prove of value if correctly performed. Description of methods of protecting orchards against killing frosts is contained in free bulletin of the State Agricultural Experiment Station, Lexington, Kentucky. The chances of killing frosts occuring at various given dates are given in Tables 5 and 6, of the present report.

In the Western Coal Field, Henderson County ranked first in 1919 in the production of apples, the yield being 229.1 bushels of apples per square mile. Hopkins County ranked second with 82.4 bushels of apples per square mile. Webster County came third with 74.4 bushels of apples per square mile. For additional statistics relative to the apple industry see Table 24. More apple trees can be planted advantageously and brought to bearing in certain locations in all of the counties of the Western Coal Field.

Peaches were produced during 1919 in greatest quantities per square mile in Butler County, the yield being 33.76 bushels. Edmonson County produced 28.98 bushels of peaches per square mile, and Grayson County 22.22 bushels. The yield of peaches per square mile in the Western Coal Field in 1919 was 17.29 bushels, while the State average was 11.44 bushels. For additional statistics relative to the production of peaches see Table 24.

The Western Coal Field in 1919 averaged 3.14 bushels of pears, 2.72 bushels of plums, and 1.48 bushels of cherries per square mile. The State averaged 1.36 bushels of pears, 1.70 bushels of plums, and 0.67 bushels of cherries per square mile. The yield by counties in the Western Coal Field is given in Table 24.

Thus it is seen that the Western Coal Field is an important fruit growing section compared to the State as a whole. The orchard industry should be expanded where conditions are favorable thereby increasing the value of the farm land and its products throughout the Western Coal Field. Before setting out an orchard, however, one should be sure that he has enough capital to finance his young orchard until it can bear sufficiently to pay for itself. He should be familiar with fruit culture. He should see that the soil is suitable and topography such as to reduce frost action so that the buds will not be damaged during severe frosts if proper methods of heating the orchard are enployed. Pickers should be available during harvest time. Adequate and economic transportation facilities from orchard to market should be present.

Grapes were grown in 1919 in largest quantities per square mile, Table 24, in Daviess County which produced 157.9 pounds for this area. Hancock County ranked second with 126.5 pounds of grapes per square mile. The Western Coal Field in 1919 averaged 48.3 pounds of grapes per square mile as compared to a State average of 37.2 pounds. It will benefit the farmers of the

Western Coal Field if fruit trees and grape vines are planted on each farm sufficient to supply the needs of the household.

ANIMALS AND ANIMAL PRODUCTS.

ANIMALS.—Farm animals in the Western Coal Field increased from 1910 to 1920 with the exception of horses, asses, burros and sheep which declined in numbers. The more animals that are kept on a farm the more economical it will be to maintain the soil fertility. The animal industry is of importance to the farmer in several different ways. Its importance in a given area is influenced by the geology and topography of the region. These inorganic controls over animal life on the farm will here be considered.

(1). More horses are kept in the Western Coal Field counties which have flat or gently rolling land than in the rougher surfaced counties. The reasons are that the more level counties have a greater percentage of their area under cultivation per square mile and there is more need for horses to do the work than in the hilly, forested areas where the land is not as intensively cultivated. Also, mules are displacing horses in the more rugged regions and elsewhere where heavy work is required.

Horses decreased in numbers from 1910 to 1920 in all of the Western Coal Field counties except Muhlenberg where the number of horses remained unchanged. The Western Coal Field in 1910 averaged 12.0 horses per square mile; and in 1920, 10.2 horses. The State averaged 11.0 horses per square mile in 1910; and 9.5 horses in 1920. The decline in the number of horses was caused by the increased use of automobiles and tractors and by the substitution of mules for horses.

(2). More mules were kept per square mile in the gently rolling surfaced counties than in the counties having a rougher relief because a greater percentage of the flat and rolling land was under cultivation. Mules, however, increased per square mile more in the rougher surfaced counties than in the gently rolling counties. For example, in counties of more rugged relief in 1910 and 1920 the average number of mules per square mile was as follows: Butler County 7.4 and 9.7 mules, an increase of 2.3 mules; Edmonson 3.7 and 6.8, an increase of 3.1 mules. In the more level counties the number of mules per square mile in 1910 and 1920 were as follows: Daviess County 8.3 and 10.1, an increase of 1.8 mules; Henderson 11.2 and 12.9, an increase of 1.7 mules; Union 12.5 and 14.0, an increase of 1.5 mules. The per cent of increase per square mile is also greater in the rougher surfaced counties than in the more gently undulating counties. Mules increased throughout the counties of the Western Coal Field from 1910 to 1920 with few exceptions. The cause for the general increase in the number of mules was stated during the discussion of horses in this report.

Burros and asses which are few in numbers in the Western Coal Field, decreased in number from 1910 to 1920.

(3) Cattle on the farms of the Western Coal Field may be divided into two classes: (a) beef cattle; (b) dairy cattle.

(a) Beef cattle were fed during 1920 in greatest numbers on the rolling lands of Union County where there were 39.2 beef cattle per square mile. Of the counties entirely within the Coal Field, Daviess County ranked second with 12.0 beef cattle per square mile. Some beef cattle are shipped into the Western Coal Field from outside counties and States to be fattened for market. The gently undulating areas fed a greater number of beef cattle than were kept in the rougher surfaced, swampy or forested areas. Thus Butler County in 1920 had only 7.7 beef cattle per square mile, Edmonson 9.1, Ohio 7.0. The same influence of topography upon the number of beef cattle per county is found to exist elsewhere throughout the Western Coal Field. The Western Coal Field in 1920 averaged 11.5 beef cattle per square mile in spite of great areas of swampy and forested land, compared to the State average of 10.7 head of cattle.

(b) Dairy cattle in 1920 averaged 14.1 head per square mile of the Western Coal Field compared to a State average of 16.4. Analyses of the dairy products produced will be considered under Animal Products.

Cattle in general are increasing in the Western Coal Field. In 1910 there were 20.6 cattle per square mile and in 1920, 25.6 cattle. The State averaged 24.9 and 27.2 cattle during these same years.

A relation exists between the number of cattle per square mile in each county and the tonnage of hay and forage produced.

Counties producing a large tonnage of hay and forage per square mile also raised a greater number of cattle than those counties having smaller yields of hay and forage. Union County in 1919 produced 99.1 tons of hay and forage per square mile, and had 46.5 cattle. In contrast, Butler County raised 42.3 tons of hay and forage and had 23.7 cattle per square mile. Table 20 and Figure 15 show the tonnage of hay and forage and number of cattle per square mile for the remaining counties.

PLATE XXIII. FRIENDS.
Scene on farm near Madisonville, Hopkins County. Note the artificial pond for the use of the live stock.

It is excellent management to produce hay, corn and other animal foods, and to keep cattle on the farm. The soil fertility is maintained and the farmer makes money from his animals at the same time.

(4) There were more sheep per square mile in counties with a rough topography than in those having gentler slopes or swampy land. Thus Butler County in 1920 had 10.3 sheep per square mile of territory. In contrast, Daviess County had 5.7 sheep per square mile; McLean 5.5; Ohio 6.9; and Union 6.4.

Sheep decreased in numbers in all of the Western Coal Field counties from 1910 to 1920. The average decrease for all of the counties taken as a whole was from 16.9 sheep per square mile in 1910 to 9.1 sheep in 1920. The State average declined from 33.9 sheep per square mile in 1910 to 17.6 sheep in 1920. The sheep require protection from dogs and other

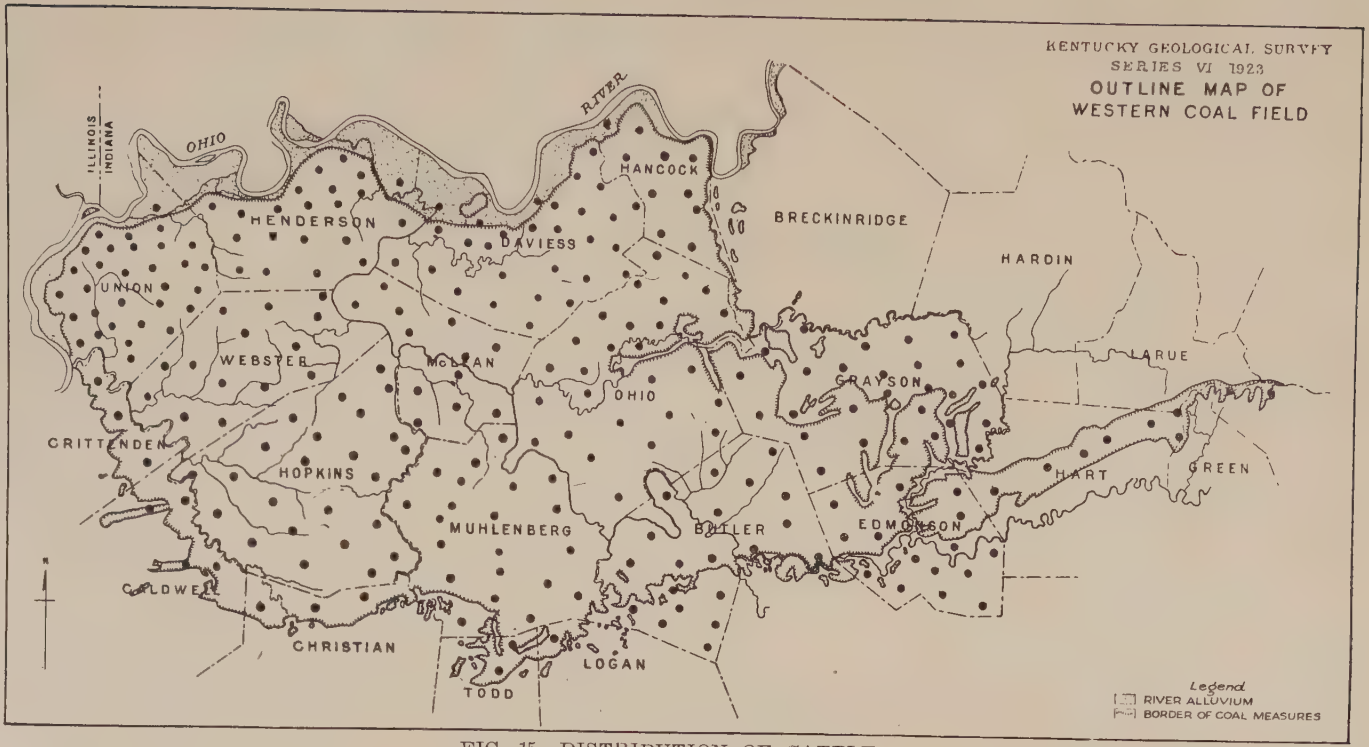

FIG. 15. DISTRIBUTION OF CATTLE.
Explanation: Each dot represents 500 cattle.

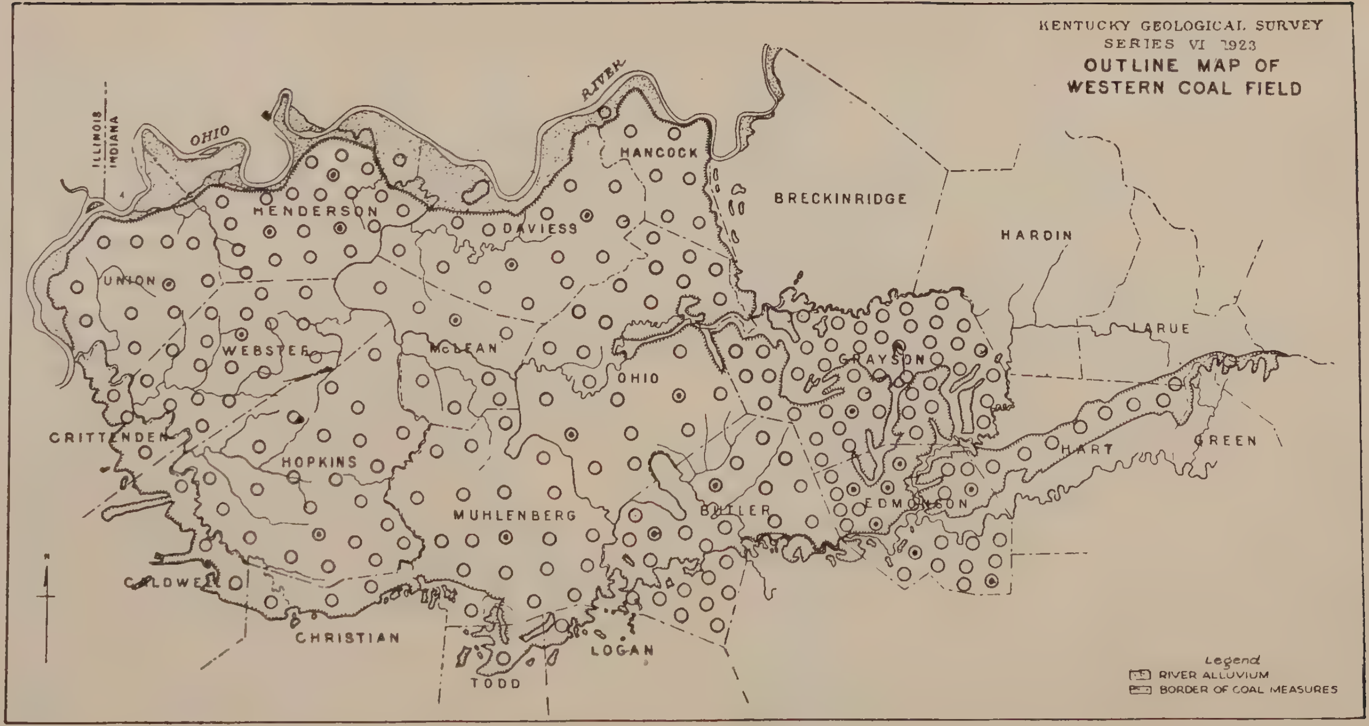

FIG. 16. DISTRIBUTION OF SHEEP AND GOATS.
Explanation: Each circle represents 200 sheep; dot in circle, 200 goats.

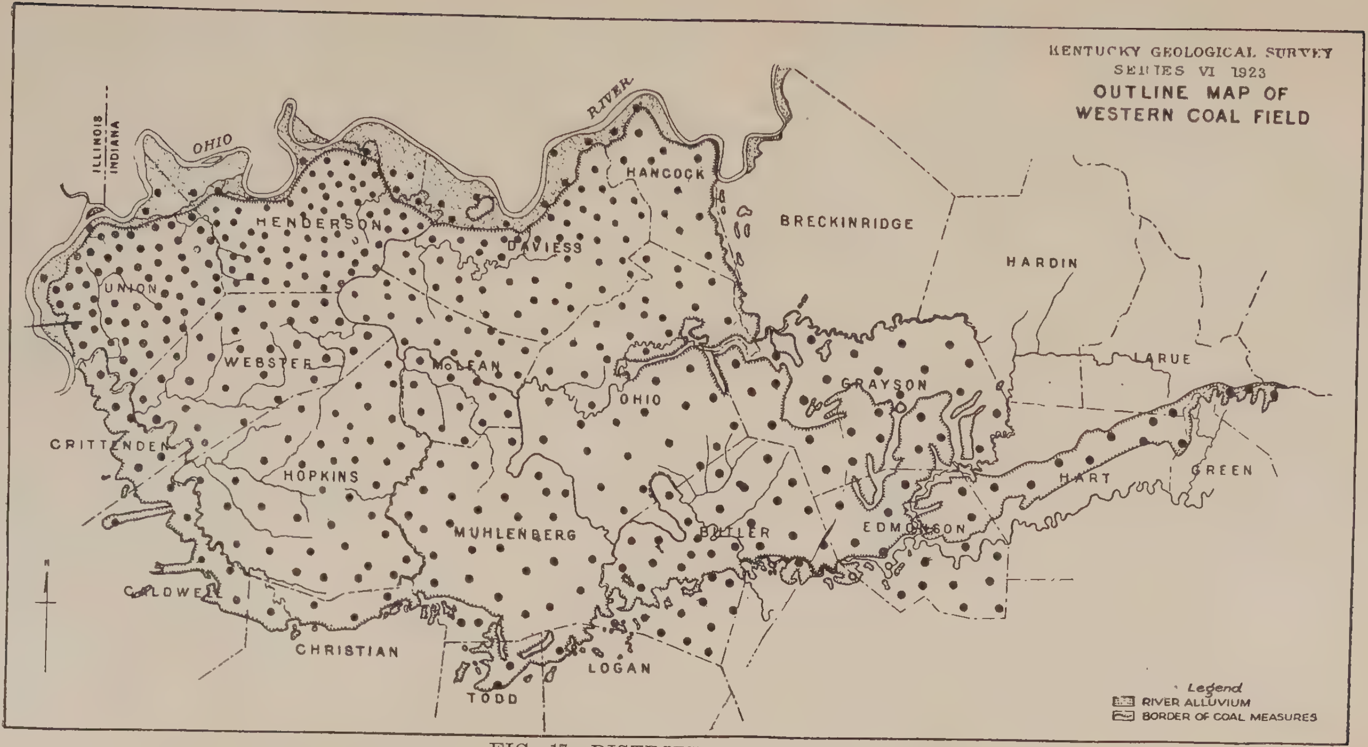

FIG. 17. DISTRIBUTION OF HOGS.
Explanation: Each dot represents 500 hogs.

foes, if they are to be raised successfully. If this protection were secured, large areas of the Western Coal Field could produce mutton and wool economically.

(5) Goats averaged 0.73 head per square mile in the Western Coal Field in 1910 and 0.88 head in 1920. The State average for these years was 0.74 and 0.87 goat per square mile.

(6) Swine are found in greatest numbers per square mile in the level and gently rolling areas, which are also large producers of corn per square mile of their territory. For example, Henderson County in 1920 had 86.2 hogs, and in 1919 raised 3,636 bushels of corn per square mile. Union County had 99.2 hogs and produced 4,385.6 bushels of corn per square mile. In contrast, Edmonson County in 1920 had 28.0 hogs and in 1919 produced 1,426.5 bushels of corn per square mile; Muhlenberg 29.3 hogs and 1,349.9 bushels of corn; Ohio 31.0 hogs and 1,693.1 bushels of corn. Table 18 and Figure 17 show that the same relationships hold true, on the average, for the other counties of the Western Coal Field.

Hogs increased in numbers from 1910 to 1920 in all but two of the Western Coal Field counties. In 1910 the Western Coal Field averaged 41.4 hogs and in 1920 45.6 hogs per square mile. The State average during this period increased from 37.1 to 37.4 hogs per square mile.

Packing houses are located at Owensboro and Henderson.

(7) Poultry should be of value to the farmer in the Western Coal Field. From 1910 to 1920 the number of poultry increased in all of the counties except Union where the number remained constant. Table 25 shows the number of poultry for each county. The Western Coal Field in 1910 averaged 212.7 head of poultry per square mile, and in 1920, 266.6 head. The State averaged in these years 218.1 and 274.2 head of poultry per square mile.

(8) Bees are found in all of the Western Coal Field counties. Union County with its more level areas, decreased its hives from 2.4 hives per square mile in 1910 to 1.0 hives in 1920. Henderson County which also has large areas of more slightly undulating land, decreased its hives per square mile from 2.1 hives in 1910 to 1.9 hives per square mile in 1920. The number of hives in Daviess and McLean also decreased during this

decade (Table 26). The hilly counties had a considerable increase in the number of hives per square mile from 1910 to 1920. Butler County increased its hives from 0.8 to 2.5 hives per square mile. Edmonson County increased its hives from 0.9 to 2.3 per square mile; Grayson, 1.0 to 2.6 hives; Hopkins, 2.6 to 3.5 hives; Muhlenberg, 1.9 to 3.0; and Ohio, 1.9 to 3.0. The Western Coal Field averaged 2.0 hives per square mile in 1910 and 2.6 hives in 1920. The State averaged in these same years 3.8 and 3.9 hives. The Western Coal Field's increase was 0.6 hives per square mile as compared to the State's increase of 0.1 hive.

The sale of poultry, eggs, honey and wax is considered under Animal Products in this report.

Animal Products.—Whole milk, due to its bulk, weight and perishable qualities, is produced and sold in greatest quantities near to the market where it will be consumed. These dairy districts must have sufficient precipitation to produce grass and other forage crops which the cows can eat. The soils must also grow good pasture. Due to the above mentioned factors, Daviess County in 1919 ranked first in quantity of milk sold, producing and marketing 440.1 gallons of milk per square mile. Owensboro which is the largest city in the Western Coal Field serves as an important market for the milk. Henderson County, which contains the city of Henderson, ranked second, selling 287.9 gallons of milk per square mile. Hopkins County, within whose borders is the city of Madisonville, came third with 263.8 gallons of milk sold per square mile. Muhlenberg County, with Central City as a market, ranked fourth, selling 185.9 gallons of milk per square mile. In contrast, counties having no large cities within their boundaries and no opportunity for economical transportation of milk to a market outside of the county, sold only small quantities of milk. Thus Butler County in 1919 sold 29.3 gallons of milk per square mile; Edmonson, 23.4 gallons; Grayson 40.6 gallons; Ohio 40.2 gallons. Table 27 gives similar statistics, as well as the total number of gallons of milk produced, for the remaining counties, the Western Coal Field as a whole, and the State.

The dairy industry should continue to increase in those districts which are advantageously situated with respect to a market. As the cities grow in size, more milk will be consumed and hence a greater number of dairy cattle will be needed. Better railroad facilities also will bring the farmer nearer to market. Many of the farmers have built silos, and those who have not as yet done so will find it a paying investment.

PLATE XXIV. FARM SCENE IN CENTRAL HOPKINS COUNTY.
A silo is a necessary part of the dairy farm equipment.

Cream is a product of higher value per pound than whole milk. Therefore with the proper facilities for shipment, it can be transported a considerable distance to market and still sold at a profit. Hancock County in 1919 sold 45.75 gallons of cream per square mile; Henderson 22.06 gallons; Daviess 17.39 gallons. The other counties sold lesser amounts of cream as shown in Table 27.

Production and sale of cream should be increased, especially in those districts which have good railroad connections with Louisville and other large cities. Cream is an excellent cash product and farmers favorably situated for shipment of this product to market should find cream a source of income well worth while.

The sale of cream in the Western Coal Field as a whole increased from 0.73 gallons per square mile in 1909 to 7.15 gallons in 1919. The State average was 3.9 gallons of cream per square mile in 1909, and 39.3 gallons in 1919.

Butter is a valuable product per pound and can be produced economically at a considerable distance from market provided adequate transportation facilities are present at the trade center to which the farmers of the surrounding district bring their products. In the Western Coal Field those districts which have these necessary railroad connections between the farming centers and city markets, can produce and ship butter in larger quantities than they do at present. In 1919 the counties selling the greatest number of pounds of butter were those which contained the largest cities in the Western Coal Field. Thus Daviess County, with Owensboro as its chief local market, sold 352.9 pounds of butter per square mile; Henderson County, with Henderson as its market, sold 282.0 pounds of butter; Hopkins County, containing Madisonville, sold 264.0 pounds of butter. On the other hand, Butler County, with no railroads and no large local markets, sold only 40.1 pounds of butter per square mile. The Western Coal Field counties' sale of butter is given in Table 27.

Cheese is also a product of high value per pound, and hence can be shipped economically for a considerable distance to market. The amount of cheese produced in the Western Coal Field in 1909 and 1919 was negligible being 0.40 pounds and 0.04 pounds respectively per square mile, as compared to a State average for these years of 1.39 pounds and 0.33 pounds.

The dairy industry is beneficial to the Western Coal Field districts where it is carried on scientifically. The dairy cattle should be fed and housed in the best possible manner. They will repay this kindness on the part of the farmer in dollars and cents.

Poultry and eggs should yield the farmer a good cash income, as well as furnishing food for the table. The poultry house should be well built, light, clean, dry, rat proof, free from vermin and well ventilated but without drafts. Eggs to be sold for eating should be infertile as they will not spoil so quickly as fertile eggs and will reach the market in better condition, thereby bringing the farmer a higher price. Eggs should also be graded as to color, size and cleanliness. Purebred poultry will pay better than mixed breeds. Information as to the care of poultry may be obtained from the County Farm Agent and the Agricultural Experiment Station, Lexington, Kentucky.

Poultry may be kept on land that is too steep and poor for the customary kinds of agriculture. Eggs and poultry are also of high value per pound and can be transported economically over the country roads to local markets. Then they can be shipped to distant markets and yet bring a profit to the farmer and merchant.

Of the rough surfaced areas in 1919, Grayson County sold 1,141.6 dozen of eggs per square mile and Butler County 1,017 dozen, whereas Daviess sold 456.6 and Henderson 401.3 dozen. Table 25 gives statistics relative to every county.

The sale of eggs increased from 575.9 dozen to 637.5 dozen per square mile of land surface in the Western Coal Field as against the State average of 615.8 and 637.9 in corresponding years.

Bees as well as poultry may be included with those animals that are suitable to both the rougher topography and the more level areas. Honey being of high value for a small bulk, can be economically transported over rough roads to local markets and thence shipped to the distant markets. The planting of sweet clover will aid the bees and at the same time enrich the soil. In 1919, Edmonson County ranked second in the production of honey with 25.2 pounds per square mile, Hopkins being first with 28.4 pounds. In general the more level counties produced a fewer number of pounds of honey in proportion to the area.

The production of honey has increased the most in the counties having a rougher topography, while in the more level counties the increase has been small or the production has even declined considerably. During 1909 and 1919 the pounds of honey produced per square mile of area in the rough surfaced counties was as follows: Butler, 5.6 and 12.1 pounds; Edmonson 12.2, 25.2; and Grayson 7.8 and 14.1 pounds. Of the more level counties, Daviess produced 14.0 pounds of honey per square mile in 1909 and 15.9 pounds in 1919; Henderson 22.9, 15.4; Union 24.2 and 7.5 pounds.

The average production of honey for the entire Western Coal Field, increased from 14.7 pounds per square mile in 1909 to 16.4 pounds in 1919. The State average increased from 38.7 pounds of honey to 39.9. Further increase in the production of honey should prove to be of benefit to the farmers of the Western Coal Field.

The number of sheep shorn in the Western Coal Field was 8.2 per square mile in 1909 and 6.2 in 1919. In 1919 the Western Coal Field averaged 34.2 pounds of wool per square mile which was considerably below the State average of 63.9 pounds. The production by counties is given in Table 28. If the sheep can be protected and a good market secured for the wool, this product should be of value to the farmers, especially to those in the rougher surfaced areas.

CHAPTER VI

HISTORY AND LIVING CONDITIONS OF THE RURAL DISTRICTS AND MINING COMMUNITIES.

Prehistoric Times.

Back in the Stone Age the Western Coal Field was inhabited by a race of prehistoric people. They are known as the Mound Builders because of the numerous mounds which they built for burial, religious and other purposes. Evidence of the life led by those ancient Kentuckians is obtained by a study of the graves, skeletons, stone weapons, implements of peace, and forts constructed at positions of natural strength. These relics of the past in the Western Coal Field, have been described by the late Col. Bennett Young (Ref. 87) who is the authority for the following statements relative to the Mound Builders.

The burial grounds of the prehistoric people in the Western Coal Field are of various kinds. Burials were made without the use of stone or wood as a protection to the bodies in Union County and along the Green River and other streams. The bodies probably were wrapped in skins or bark and protected by some temporary covering. Small and large stone graves occur in Edmonson and Christian counties as well as in counties outside the Coal Field. Graves were made in the rock houses beneath overhanging cliffs. Bodies were also covered by mounds. A number of these mounds have been explored in Union and other counties.

Charcoal and ashes left from the funeral fires are found associated with the mound type of grave as well as with other places of burial. Implements of peace and weapons of war and the chase were usually interned with the deceased.

Relics of these prehistoric people have been discovered in places not associated with burial grounds. Near Uniontown, Union County, a cache of 140 hornstone knives was found. Also six miles above Caseyville in the same county, two caches were discovered during 1884. They contained 56 and 75 specimens of stone weapons and implements. Caches have been found in Caldwell, Christian and other counties. A scepter of dark gray

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chert, 15¼ inches long and over 5 inches wide at the points, was found in Edmonson County (Ref. 87:191). A banner stone was discovered in Hancock County, a "boat stone" resembling a canoe, in Crittenden County, and stone axes, gorgets and numerous other relics throughout the Coal Field. Several caves in the limestone bordering the Western Coal Field have been rich in archaeological remains. Prehistoric forts occur in Edmonson, Hopkins and other counties.

COLONIAL TIMES.

After the disappearance of the Mound Builders, Indian tribes inhabited Kentucky. As time went on, white explorers penetrated into this territory. Several of the early English expeditions to colonize North America included the area of Kentucky in their charters. Settlements were made along the Atlantic seaboard. The pioneers, mostly from Virginia and North Carolina, made their homes in the wilds of what is now Kentucky. There were two ways in which the land was obtained. One class held their land under Army grants made by the government for services rendered by these men during the American Revolution. The second class took up land by the process of settling upon it and making a few improvements (Ref. 54:425, 426). The settlers erected their cabins near springs and streams on the ridges and uplands where the land was dry. The river bottoms were in many instances swamps or too damp to be healthful. About the settlers were the primeval forests in which they made clearings where they planted their crops. The people from Virginia having grown tobacco at home, planted tobacco in Kentucky. It became their cash crop. Corn was raised and used for food by both animals and man. Game was plentiful. Indians roamed the forests, sometimes on the warpath.

What is now Kentucky became a part of the County of Fincastle of the State of Virginia. On December 31, 1776, Fincastle County was divided into three counties of which one was called Kentucky. In May 1780, Kentucky County was divided into the three counties of Jefferson, Fayette and Lincoln. Each of these three counties has been subdivided and many new counties formed. The development of the Western

Coal Field counties as they exist today, stated in the order of their creation is given in Table 29.

MODERN TIMES.

The modern Western Coal Field city has paved streets, electric lighting system, municipal water works, sewerage disposal, excellent schools, and many fine public buildings and private residences. In a few cities the quality of the drinking water might well be improved, but doubtless that will soon be remedied. Dwellings near the Ohio River are sometimes built on posts to make them drier during times of flood.

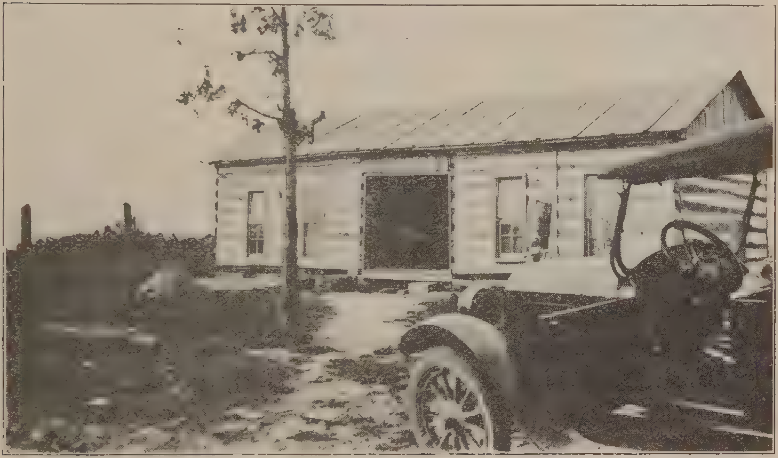

PLATE XXV. A LOG CABIN.
Location somewhat north of Brownsville, Edmonson County. Note the porcelain sink. Photo by W. R. Jillson.

In the gently undulating and moderately hilly areas farm life is similar to that found in any thriving rural district throughout the United States. The houses as a rule are of moderate size often painted white and present a pleasing appearance. Plate XXII shows a typical farm scene in the areas under discussion. Occasionally imposing residences occur surrounded by beautiful grounds. The average barn and other buildings are well constructed. Where dairy cattle are kept, large silos are quite often found. Water is provided for the livestock by damming small brooks or filling up the outlets of small depressions in the fields. A pond of water such as is shown in Plate XXIII is a common sight. The fields are fenced.

In the more hilly districts and the rough surfaced southern and eastern margins of the Coal Measure strata, log cabins are seen. Some are single room cabins, others have two rooms. Another type occasionally found is made up of two separate one room cabins with an out of door covered passage between the two rooms, Plate XXV. There are also one story, board dwellings, known in some parts of Kentucky as "box-houses," Plate XXVI, built with one or two rooms. Large houses occur resembling in appearance the dwellings in the more level areas. Now and then a large stone or brick chimney extending up one end of the log cabin or frame dwelling gives an added touch of picturesqueness to the home. In some of the hill country homes, modern conveniences and semi-luxuries of the present day are seen within dwellings which on the exterior present the appearance of pioneer times. Thus a porcelain bath tub, phonograph, sewing machine and the like are found in various mountain homes. The daily newspaper is common along the U. S. Rural Mail Route. Practically all the cabins and frame dwellings are neat and clean.

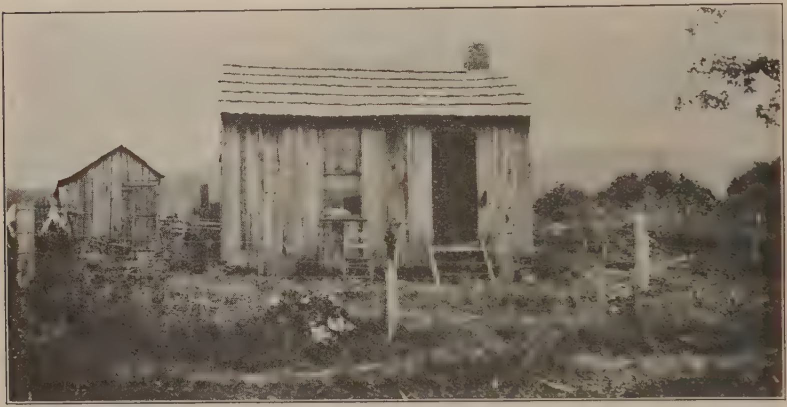

PLATE XXVI. A "BOX" HOUSE.

This type of dwelling is most frequently seen in the more rugged regions and on the outskirts of coal mining camps. This photo was taken in southern Hopkins County.

The food in these rugged areas is typical of the mountains, consisting of eggs, soda biscuit, pork or bacon in gravy, milk and very strong coffee. In some regions remote from a railroad, canned berries of many kinds are served, and butter, probably in honor of the guest. Throughout much of the rough Pottsville conglomerate belt, many of the people are rather poor. Their fields are small patches on the steep slopes of unfertile soil, where they endeavor to raise tobacco and corn. They lead a wholesome out-of-door life but occasionally ailments such as hookworm and trachoma occur.

PLATE XXVII. COUNTRY LIFE AMONG THE HILLS OF NORTHERN CHRISTIAN COUNTY.

Note the large chimneys built many years ago at either end of this house.

The live stock are watered at springs, streams or wells. The barns as a rule are not as nicely kept up as those in farming areas having richer soils.

This same influence of geology and topography upon the living conditions of the people is shown strikingly throughout the projection of Pottsville deposits which extends out from the main mass of the Coal Field, as a narrow tongue of rough land through Hart County and along the boundary of Larue, Green, Taylor and Marion Counties. Within this belt of Pottsville strata the roads are narrow and rough. The life conditions are the same as have been described above. On either side of the dissected Pennsylvanian strata are limestone areas with broad, comparatively gently sloping valleys. Here the houses and barns are well built and often painted. The people appear prosperous. The main roads are piked. This difference is entirely due to the geologic formations of the two regions.

In both the level and hilly areas of the Western Coal Field, are the mining camps and towns. Some mines are located within or close to the large cities. This condition occurs at Central City, Henderson, Morganfield and other towns. Elsewhere numerous small mining villages or camps have been built near the mine or group of mines at which the people work. Many of these villages are made up of neatly painted houses, regularly spaced along clean streets, such as is shown in Plate XXVIII. Other camps are not as orderly in appearance. On the outskirts of some camps occur a few dilapidated frame houses, often inhabited by a floating type of labor. These people move from place to place at will and have no desire to beautify their surroundings. In general, however, the coal mining camps are well kept up and present a good appearance.

PLATE XXVIII. COAL MINERS' HOMES.

These houses on the property of the Sunlight Mining Company near Madisonville, Hopkins County, are neat and attractive.

Everywhere throughout the Western Coal Field, in lowland and hilly districts, cities and country, the people are courteous and helpful.

ILLITERACY.

Illiteracy exists in all of the counties of the Western Coal Field as is shown in Table 30. An illiterate, as defined in the Fourteenth Census of the United States, is a person ten years of age or over who is unable to write in any language, not necessarily English, regardless of ability to read. Many illiterates can neither read nor write.

The percentage of illiterate among the native white population is influenced by the topography. Counties having a rough surface have a higher per cent of illiteracy than the more level counties with their better roads. Thus in 1920 Butler County had 10.5 per cent of the native white population illiterate, Edmonson 11.2 per cent, Grayson 9.1 per cent and Muhlenberg 10.0 per cent. In contrast, the level or gently rolling Daviess County had only 4.0 per cent native white illiterates, Henderson 4.2 per cent and Union 4.2 per cent.

A comparison of the per cent of illiteracy among the various races in the Western Coal Field shows that in 1920 there were 6.8 per cent of the native white population illiterate, 7.8 per cent of the foreign-born whites and 20.0 per cent of the negroes. The illiterate negro population increases the per cent of illiteracy for the total population much higher than it otherwise would be.

Illiteracy, however, is decreasing throughout the Western Coal Field as Table 30 shows. The per cent of illiterates among the total population decreased from 11.2 per cent in 1910 to 8.2 per cent in 1920. This total decrease in illiteracy occurred among the various classes as follows: Native white illiterates decreased from 9.2 per cent in 1910 to 6.8 per cent in 1920; foreign-born whites from 9.4 per cent to 7.8 per cent; negroes from 25.9 to 20.0 per cent. This advancement in general education is encouraging and should be continued and increased as rapidly as possible.

The rural schools have the topography and climate to combat. In the hilly districts the public school year for the rural schools often commences in July or about August first, and closes in January or February. This early opening of the rural schools is due to the bad condition of the dirt roads during the winter.

Counties having more level land and good roads have their rural school year commence about the last Monday in August and continue for eight months. In Union County, where this practice is followed, there are two exceptions. One of these schools is in the river bottoms, the other is on an island in the Ohio. These two schools begin their term the first week in August and continue until high water interferes with the sessions, which usually occurs in January or February.

PLATE XXIX. AN ATTRACTIVE RURAL SCHOOL.
In the hills of northern Christian County.

Many of the rural schools are well built, freshly painted and surrounded by neat yards. An attractive rural school in the hills of northern Christian County is shown in Plate XXIX. The city school systems and buildings are excellent. High schools are located here and there throughout the counties under discussion. The city and town schools, with some exceptions, open the first part of September and continue for eight and a half to nine months.

The large cities have excellent public libraries . The Owensboro Public Library is shown in Plate XXX. Preparatory schools and colleges have been established in a number of the towns. Information concerning these institutions of learning can be secured by consulting Patterson's Educational Directory.

HEALTH CONDITIONS.

The death rate from several diseases which occur in the Western Coal Field, is influenced by the geographic location. Table 31 shows that, in general, the counties having large numbers of their population in cities, have a higher tuberculosis death rate than occurs in the counties having most of their population living in the rural districts. Thus from 1911 to 1921, Daviess County, within whose boundaries is the city of Owensboro, had an average death rate by tuberculosis of 202.2 per 100,000 population; Henderson County, which includes the city of Henderson, 211.6; Hopkins County, with Madisonville as its county seat, 204.1. In contrast, Butler County had a tuberculosis death rate of 186.1; Edmonson, 139.5; Hancock, 185.8; Ohio, 150.1. The State death rate was 180.1. The explanation for the variation in death rate, is that the more congested the population and sedentary and indoors the life of the people, the higher is the death rate from this disease. The out-of-door life of the people in the rural districts keeps the death rate from tuberculosis at a lower figure.

PLATE XXX. THE FREE PUBLIC LIBRARY, OWENSBORO.

The pneumonia death rate in general, bore the same relation to the distribution of the population as is found in that of tuberculosis. Thus from 1911 to 1921, the average death rate by pneumonia per 100,000 population in Daviess County was 109.5;

Henderson County, 128.7; Hopkins, 104.5; Butler, 62.0; Edmonson, 83.8. The State average was 124.2. Plenty of fresh out-door air is seen to be a preventitive against pneumonia as well as tuberculosis.

Deaths from typhoid are far too common in the Western Coal Field. Compare the average death rate during 1911 to 1921 from typhoid per 100,000 population of 54.0 in Webster County, 38.8 in Ohio, 48.1 in Hopkins and similar figures for the majority of the remaining Coal Field counties with an average in the Bluegrass of 28.7 and in the Knobs 32.1. It is obvious that more precautions should be taken against the use of contaminated drinking water. Water from streams, coal mines and open wells is dangerous unless properly treated. Flies also should be eliminated as far as possible. This can be done readily with a little labor and care.

The death rate from cancer is markedly higher in counties containing large city populations as compared to counties almost entirely rural. From 1911 to 1921 the average death rate from cancer per 100,000 population in Daviess County was 55.5; Henderson, 45.0 and Hopkins, 48.8. In contrast the death date from this disease in Butler County was 25.1, Edmonson 32.8, Grayson 29.5, McLean 33.5, Ohio 28.6. This relationship of the death rate by cancer to the congestion of population is borne out by the fact that from 1911 to 1921 the average death rate per 100,000 population due to this disease in the Bluegrass with its large cities, was 62.4, whereas in the Eastern Kentucky Mountains it was only 20.9. During the five year period from 1916 to 1921 the death rate by cancer in Owensboro was 85.5, Henderson 57.5, Bowling Green which is outside of the Western Coal Field had a death rate from cancer of 106.1 and Hopkinsville 84.3.

A comparison of the deaths caused by tuberculosis, pneumonia, diphtheria, typhoid and cancer in the various physiographic divisions of Kentucky and the State as a whole, is given in Table 32.

Malaria which formerly was common in certain lowland areas, is becoming less prevalent as the swamps are drained. Hookworm and trachoma occur in some districts but with due precaution these diseases can be eliminated.

Eradification of preventable diseases throughout the Western Coal Field will cause an immense increase in the health, industry and wealth of the people. Free literature describing how to prevent the contracting of several of the diseases mentioned above and how these ailments are cured, may be secured upon request from the Kentucky State Board of Health at Louisville, Kentucky.

Ownership of the Land.

The physiography, fertility of the soil and additional factors controlling the value of the land, have an important influence on the number of owners, managers and tenants operating farms in each of the Western Coal Field counties. The level and gently rolling, fertile lands with high value per acre and good transportation facilities, have a higher per cent of tenants on farms than do the more hilly and remote counties with their lower value per acre. This relationship between the physiography and tenancy is due to the fact that as land rises in price in the richer farming areas, it becomes more difficult for the man with small capital to buy a farm. It is more desirable to rent a farm at lower interest rates than would be charged if he borrowed the money to buy the farm. Other methods of paying the owner for the use of his land are also advantageous to the tenant as compared to the purchase of the farm.

On the larger farms, especially, it is difficult and sometimes almost impossible to hire efficient labor at a wage small enough to yield the farm owner a profit on his farming operations. It will net the land owner more money to rent or lease his land out to tenants. In the hilly sections it is difficult for the land owner himself to make a living from the soil in the more infertile areas. For a tenant to make a living from the farm and also pay the landowner for the use of land is too difficult a task for many men to undertake. The rough land is cheap in comparison to the level and gently rolling areas of the richer farming counties and there is little labor saving machinery that can be readily used in many of the rugged districts. Thus in the hilly regions it is easier for the poor man to buy a farm and equipment and work the land himself than it is in the richer territories.

Examples of the geographic and economic principles described above are here given, the per cent of all farms worked by tenants and the value of the land per acre in 1920 for the richer farming counties, being as follows: Daviess 44.9 per cent, $92.21; Henderson 50.7 per cent, $79.14; Union 49.4 per cent, $85.35. In contrast statistics dealing with the same factors for rougher surfaced counties, and those having wide areas of swamp land in need of drainage or second growth woodland yet unreclaimed, are as follows: Butler 20.5 per cent of all farms are worked by tenants, assessed value of farm land per acre $15.84; Edmonson 27.5 per cent, $14.76; Grayson, although only partly in the Coal Field, 19.2 per cent, $18.61; Ohio 20.3 per cent, $24.28. Similar data for the other counties of the Western Coal Field is given in Table 33.

Tenancy in the Western Coal Field from 1900 to 1920 increased in actual numbers by 42 farms worked by tenants. There was an increase, however, of 1,572 farms during this time. Due to the greater proportional increase in total number of farms than in farms worked by tenants, the per cent of tenancy declined from 35.0 per cent in 1900 to 33.4 per cent in 1920.

Comparatively few farms are operated by managers. In 1910 only 0.3 per cent of all farms in the Coal Field were worked by managers; in 1920, 0.4 per cent. In the comparatively level counties there are more managers on farms than in the hilly counties. Thus in 1920,, Daviess County had 21 farm managers; Henderson 32; Butler 5; Edmonson 1.

The color and nativity of farm owners and tenants in the Western Coal Field is given in Table 34. Taken as a whole native white farmers have increased from 30,029 in 1910 to 30,960 in 1920; foreign-born white farmers decreased from 130 to 63; and colored farmers decreased from 1,485 to 1,441. The native white farmers are becoming more numerous while the other members of the agricultural population are diminishing in numbers.

In the more mountainous counties the farmers, both owners and tenants, are nearly all native white. Negroes are far more plentiful in more level counties where there are farms with greater acreage under cultivation, which employ hired labor.

Thus in 1920 only 2 per cent of the farmers of Butler County were negroes and 2 per cent in Edmonson County whereas Daviess County had 8 per cent and Henderson 14 per cent.

In 1920 Daviess County had 56 per cent of the native white farmers working their own farms; Henderson, 52 per cent. Of the more rugged counties Butler had 79 per cent and Edmonson 72 per cent of the native white farmers operating their own farms. In the Western Coal Field, as a whole, 80 per cent of the foreign-born farmers worked the farms which they owned in 1920, the majority being in the more level counties. There was a higher per cent of negroes working their own farms in the rugged and more remote areas than in the richer agricultural districts. Butler contained 75 per cent of negroes working their own farms; Edmonson 70 per cent; Daviess 31 per cent; Henderson 24 per cent.

Geographic environment influences the nativity and color of the tenants in the Western Coal Field. The greatest number of negro tenants is in Daviess and Henderson Counties. The rougher surfaced areas with large woodland or undrained areas, have few colored tenants. For additional statistics dealing with tenancy see Table 33.

In conclusion, it is seen that tenancy in the rugged areas of the Western Coal Field never will be a problem as the physiography of these regions prevents its undue development but in the level and gently rolling counties with their richer soils and large areas of cultivated land per farm, the per cent of farms worked by tenants has become high. For example, Henderson County in 1920 had 50.7 per cent of all its farms worked by tenants as compared with the State average of 33.4 per cent.

CHAPTER VII

HIGHWAYS AND TRANSPORTATION.

Roads.

The roads throughout the Western Coal Field are influenced by the topography. A road parallels the Ohio River for many miles, running near the bank. Other roads connect various parts of the level river plain. In the uplands the roads are sometimes apt to follow property lines extending up and down steep slopes, many of which could have been avoided if the road had been laid out with relation to topography. In the hilly regions a great many of the roads follow the comparatively level tops of the ridges, thereby securing a more gentle gradient and also better drainage. Occasionally the highways follow the valleys but unless the swampy bottom lands have been drained, these roads are poor. Where the lowland roads have been ditched and otherwise cared for, they make good highways. Private roads branch off from the public highways to farmers' houses. Highways classed as "main auto roads" connect the principal towns of the Coal Field. Numerous villages and towns which have no railroads passing through them, are brought into closer touch with the larger towns and cities by these automobile highways. Thus Calhoun, the county seat of McLean County, is on the automobile road from Owensboro to Greenville; Morgantown, the county seat of Butler County, is on the automobile road from Owensboro and Hartford to Bowling Green; and many other instances can be cited. An important trail, known as the Dixie "B" Line, passes from Indiana into Kentucky at Henderson. Ferry boats transport the automobiles and other vehicles across the Ohio River. From Henderson this road leads southward through Dixon, Madisonville and Nortonville to Hopkinsville and points further south.

The majority of the roads throughout the Western Coal Field are dirt. The main traveled highways are wide enough to allow vehicles to pass each other readily, but the less frequented roads are often too narrow. In wet weather, especially during the winter, many become so badly cut up and muddy as to be almost impassable, in places, for loaded vehicles. Dirt roads on the steeper hillsides may wash badly. In dry weather dirt roads are quite good although in the hilly districts they are sometimes very rough. Roads in the loess areas of Union and other counties become extremely dusty, the fine dust rising in clouds as the vehicles pass. The main roads are usually crowned. Near the Ohio River the principal roads are sometimes surfaced with gravel for some distance into the country from the larger towns. Daviess County is credited with having 125 miles of turnpike, according to the Twenty-fourth Biennial Report of the Kentucky Bureau of Agriculture. Henderson County ranks second with 97 miles of turnpike. In contrast among the hilly counties, Butler had 6 miles of turnpike, Grayson 10, and Muhlenberg 7. Additional mileage of turnpike is being constructed in various counties. Road material can be secured from the limestone strata where it comes near enough to the surface to be quarried, as it does near Madisonville. Gravel is obtained along the Ohio River. Edmonson, Grayson and other counties along the eastern and southern border of the Coal Field, contain excellent rock asphalt deposits. The Mississippian limestone bordering the Coal Field on the south and east are obtainable, if the transportation charges are not prohibitive. Bridges are rather rare, traffic being obliged to ford the shallow streams and be ferried across the larger rivers.

Improvement of the highways throughout the Western Coal Field will greatly benefit the inhabitants. A few of the advantages which good roads will bring are as follows: increase in land values; saving in time and energy of men and teams hauling goods over good roads as compared to poor ones; reduced wear and tear on wagons and harness; ability to market crops when desired, thereby often securing a higher price for farm products than might have been obtained if the commodities were taken to market at only the period when the roads permitted travel with loaded vehicles; larger school attendance; consolidation of small rural schools into one large school for the district, if desired; closer social intercourse among the farmers; more frequent attendance at church and other meetings.

RIVER NAVIGATION AND FERRIES.

RIVER NAVIGATION.

Steam packets, towboats and barges, gasoline and kerosene launches, and an occasional theatre boat move up and down the Ohio and Green Rivers.

On the Ohio River the Louisville and Evansville Packet Company, and a number of smaller boats operate. They bring general merchandise from the cities to the smaller towns, and take back various products of the land. A small quantity of sewer pipe is shipped by water from Owensboro. The regular line boats carry passengers. Coal, steel rail and pipe are barged down stream from Pittsburg and other points in the Appalachian coal fields past the Western Kentucky Coal Field to markets along the Mississippi River. Western Kentucky coal is loaded onto barges at a river tipple on the Ohio near the mouth of the Tradewater. This coal is floated down the Ohio and Mississippi Rivers to be sold in the Southern States. Dredges obtain sand and gravel from the river banks and bars. Theatre boats bring entertainment to the river towns. Ferry boats make frequent trips from such cities as Owensboro, Plate XXXII, and Henderson to the Indiana shore and return.

PLATE XXXI. TRANSPORTATION ON THE OHIO RIVER.
View from Owensboro looking upstream.

The Ohio River traffic is far less than before the present development of railroad transportation. Difficulties in navigation encountered during periods of low water also tend to injure river traffic. Steamboats have difficulty during low water within the reach of the Ohio past Union to Hancock Counties. Some of the river towns which were formerly important trade centers due to the transhipment of goods from land to water carriage and vice versa, have declined to small local trade centers. Uniontown is an example of a town which has suffered from the decrease in river traffic. Cities such as Owensboro and Henderson, because of other factors and their better commercial position, have continued in their growth, now aided by railroads

PLATE XXXII. FERRYBOAT LEAVING THE FLOATING DOCK AT OWENSBORO.
Scene looking up the Ohio River.

Improvements in the Ohio River during the past few years, together with economic factors, have increased the quantity of goods shipped by water. The project for the improvement of the Ohio River, as outlined by G. R. Lukesh, Lieut.-Col., Corps of Engineers, U. S. War Department, in a communication to the author is as follows: The Government "contemplates the construction of a series of locks and movable dams to provide a minimum channel depth of nine feet from Pittsburg, Pennsylvania to Cairo, Illinois. Dam No. 46 at Owensboro is the 46th dam beginning from Pittsburgh; Dam No. 47, the next dam below 46, is located at Newburg, Indiana, and is now under construction; Dam No. 48, six miles below Henderson has been completed and is in operation; Dam No. 49 will be located near

Uniontown; Dam No. 50 will be located near Weston below Tradewater River and beyond the limits of Union County."

At the boat landings in Owensboro and Henderson the bank, which slopes quite steeply down to the river, is paved with stone blocks, Plate XXXIII. At each city a few yards out in the stream, near the foot of the slope, is a floating dock, which is reached by a gangplank from the shore. These docks are used by the regular boats. When the river rises during certain periods of the year, the dock is moved shoreward up the face of the paved slope.

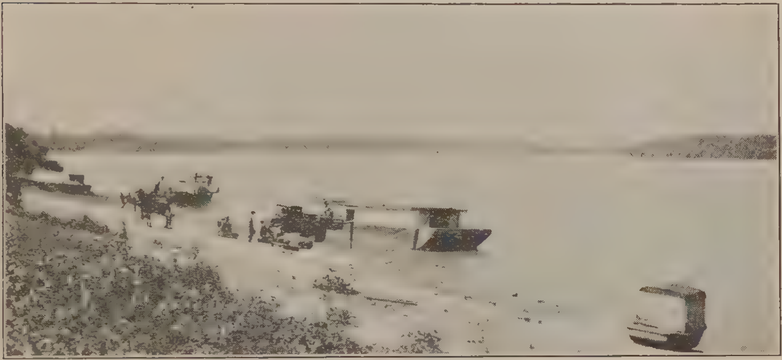

PLATE XXXIII. TRANSHIPMENT OF GOODS FROM BARGE TO MOTOR TRUCK.

View looking down the Ohio River at Owensboro. Note the rock-paved slope leading to the water's edge.

In general the Ohio River usually rises highest in February or somewhat later. Rains may cause a lesser rise in May or June, and a small rise sometimes occurs in November or December. At Owensboro in time of flood the water comes up over the foot of Ste. Ann's Street. High water marks and dates at which they occurred as recorded at the City Engineers Office, Owensboro, are as follows: 1883, 43.98 feet; 1884, 44.31 feet; 1912, 44.31 feet.

The lowest stages of the Ohio River, in general, are reached in August or September and may extend into October. (Ref. 56.)

The Evansville and Bowling Green Packet Company operates steamboats on the Green River to Mammoth Cave. Boats for

Bowling Green leave the Green River and go up the Barren River to their destination. They carry passengers and general merchandise. Smaller boats also ply back and forth at irregular intervals. A number of towns without railroad connections are served by the riverboats. Among the bulky products these boats carry are brick, tile, stone, and other heavy materials. Rock asphalt is taken by barge from the quarries of the Kentucky Rock Asphalt Company on the Nolin River to Bowling Green, and from the Natural Rock Asphalt Co. on Bear Creek to Rockport on the I. C. R. R. Logs were formerly floated down the Green River to the Ohio, but this method of getting logs to more distant markets is not much employed at present. Logs are floated down the Rough and Green Rivers to Livermore, where there are several wood working establishments.

The Tradewater River becomes so low in dry weather that it is not used for navigation purposes.

FERRIES.

The rivers are spanned by railroad bridges, but vehicles have to be ferried across the larger streams. The ferry boats vary in size and mode of propulsion from gasoline and kerosene driven launches to flat scows pulled across by means of hauling on a stationary wire cable. A launch crossing the Ohio River

PLATE XXXIV. A FERRYBOAT ON THE TRADEWATER RIVER.

The boat is moored to the Webster County shore. A wire fastened to the tree just back of the boat stretches across the stream and is used to haul the boat back and forth.

above Owensboro is shown in Plate XXXII. A simple scow type of ferry on the Tradewater River is shown in Plates I and XXXIV. Many of the small streams have to be forded.

RAILROADS.

The principal railroads serving the Western Coal Field counties are the Illinois Central, Louisville & Nashville, and the Louisville, Henderson & St. Louis. The mileage of each of the roads by counties is given in Table 35. In addition to the large railroad systems there are the Kentucky Midland Railroad which has 9.11 miles of track in Muhlenberg County; and the Mammoth Cave Railroad, 6.74 miles in length in Edmonson County, outside of the coal field strata. The total length of the railroads in the Western Coal Field counties, including the Mammoth Cave Railroad, is 562.29 miles, which is one mile of railroad for 8.62 square miles of territory. Additional railroad lines are under construction, Plate XXXV.

PLATE XXXV. RAILROAD CONSTRUCTION.
The Illinois Central Railroad's new line here shown as it was being built across Hopkins County during the summer of 1923, extends from Muhlenberg County to Dawson Springs.

In the main the Western Coal Field is well served by railroads as is shown in Figure 1. One can go quickly and inexpensively from city to city. Railroads extend due south from Owensboro to Central City and the South, and from Henderson to Madisonville, Hopkinsville and on into Tennessee. The Louisville, Henderson & St. Louis Railroad stretches along the

Ohio River border, connecting that part of the Western Coal Field with Louisville. Henderson is in touch with Evansville, Indiana by rail. Railroads traverse the western margin of the Coal Field, a few passing out of Kentucky on their way westward. From Central City the Illinois Central crosses Ohio and Grayson counties on its way to Louisville. Other railroad lines traverse various portions of the Coal Field.

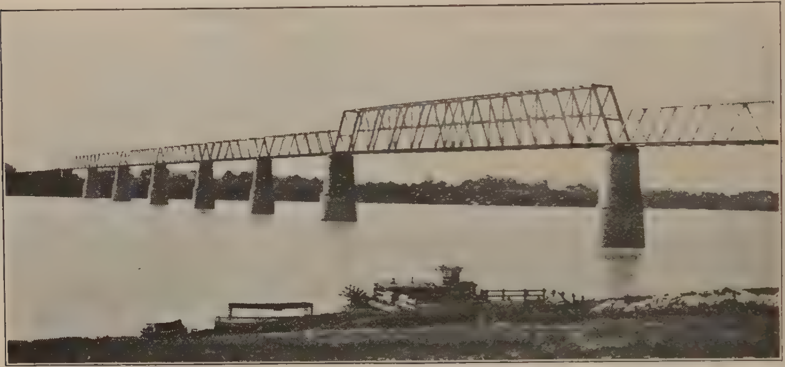

PLATE XXXVI. RAILROAD BRIDGE ACROSS THE OHIO RIVER AT HENDERSON.

The rivers are spanned by good bridges, the one crossing the Ohio at Henderson, Plate XXXVI, being especially imposing. The railroads follow the valleys as far as possible, with occasional tunnels through the hills.

There still exist large areas which are a considerable distance from a railroad. Butler County and the Coal Field portion of Edmonson have no railroads, although a railroad passes for a short distance, through a part of Edmonson County outside of the Pennsylvanian strata. Calhoun, the county seat of McLean County, is off the railroad. In Hancock County the railroad stretches solely along the northern border near to the Ohio River. Portions of the Pottsville conglomerate projection from Hart County eastward, along the boundaries of Larue, Green, Taylor and Marion Counties, are miles away from a railroad. Other districts could be mentioned which have no railroad facilities.

Towns remote from the railroads can be reached by automobile or buggy, taken from the nearest railroad station. If desired, one can go by boat to towns and villages situated on the Green River.

The commodities carried by the railroads are chiefly merchandise, agricultural products, coal, rock asphalt and lumber. Railroad transportation has absorbed much of the river traffic which in the earlier days was such a factor. Towns which formerly were important points of transhipment of goods from river boats to rail and vice versa, have declined and are of minor importance unless, aided by their position relative to distribution of goods by rail, they have become important manufacturing and commercial centers. Thus Henderson and Owensboro are flourishing river cities, well served by rail, while Uniontown once an important river terminus, is a quiet village. The Ohio River is still used to some extent in the transportation of Western Kentucky coal. Coal is taken by rail to a tipple on the Ohio near the mouth of the Tradewater River. From the tipple the coal is loaded onto barges which are floated down the Ohio and Mississippi Rivers to markets in the South.

CHAPTER VIII

THE COAL INDUSTRY.

The first commercial coal mining operation in the Western Coal Field was a drift mine opened along the Green River in Muhlenberg County in 1820 by William D. McLean. In 1825 several small mines were started in the Bon Harbor Hills, Daviess County. In 1828, there were 328 short tons of coal mined and sold in Kentucky. (Ref. 49:43, 62; 39:251-252). The coal produced along the Green River was taken out in barges to Henderson, Kentucky, and Evansville, Indiana. (Ref. 76:33-36; 49:44). By 1887, there were 43 coal mines in the Western Coal Field. Since that time the coal mining industry has increased greatly. The location of the coal mines at the present day are shown on the geological map, Figure 1.

"Those coals which enjoy the widest commercialization, with the localities in which they are now being operated," according to Dr. W. R. Jillson, State Geologist, (Ref. 49:69), "are as follows: (1) No. 12 seam, Hopkins and Webster counties; (2) No. 11, Webster, Hopkins, Union, and Ohio counties; (3) No. 9, Muhlenberg, Henderson, Ohio, Union, Webster, Hopkins, McLean, and Daviess counties; (4) No. 14, Muhlenberg

PLATE XXXVII. A STEEL TIPPLE.
View at Mine No. 3 of the Southland Coal Company, Henderson City.

County; (5) Nebo (or Baker seam according to some authorities), Hopkins and Henderson counties; (6) Mannington or Empire seam, Christian County."

Four coal seams are mined in Hancock County states A. M. Miller, (Ref. 58:283). The lowest it has been suggested might be the I-B seam. Cannel coal is produced in Breckinridge County. Several minor coal beds that are worked locally have already been mentioned in the present report under the subject of Coal Seams.

The coal is mined chiefly by shafts and slopes. The depths of the shafts vary with the geologic structure. Data relative to the depth of coal beds beneath the surface can be found in the bulletins of the Kentucky Geological Survey listed in the Bibliography of this report.

In underground mining the ordinary room and pillar method is usually employed, although the panel system of room and pillar is coming more into use. Many of the mines have electric mining machines, electric haulage, and are equipped with modern fans, steel tipples and the like. Wooden tipples, however, are seen throughout the Coal Field. Some of the slope mines are small affairs, known as "wagon mines." Their equipment is of the simplest. Many are worked at a nice profit during times of high priced coal, but with a decided slump in the market some of these mines suspend operations.

Mining is also carried on by stripping the overburden from the coal seam either with mules and scrapers, or with steam-shovels. This method can only be used where the coal is near the surface. At the larger open pit mines, the coal is often loaded into the mine cars by steam shovels of smaller size than the stripping shovels. The Sunlight Mining Company's operation near Madisonville, Hopkins County shown in Plates X, XXXVIII, is an example. At this strip mine where the overburden averages about 27 feet thick, coals 11 and 12, together with a four foot massive limestone that comes between the seams, are excavated. The coal is washed at the company's washery; and the limestone is crushed at the plant of the Sunlight Crushed Stone Company, after which it is sold for road metal and agricultural lime.

Most of the coal mined in the Western Coal Field is sold for fuel purposes, but coke is made in some of the counties. The first coke was procured in commercial quantities in 1880. Forty-five ovens that year made 4,250 tons of coke. In 1887, the Clifton coal mines of Hopkins County were the only mines manufacturing coke. In 1918, there were 155 beehive ovens in the Western Coal Field with an output of about 25,000 tons of coke.

PLATE XXXVIII. COAL STRIPPING.

Seams Nos. 11 and 12 are being mined by steam shovels on the property of the Sunlight Mining Company near Madisonville. A limestone which separates the coal seams is excavated, and prepared for agricultural lime and road metal at the plant of the Sunlight Crushed Stone Company.

In the Western Coal Field the coal is gotten to market over the Louisville and Nashville Railroad, the Illinois Central Railroad and other lines. Coal is also barged down the Ohio River. The West Kentucky Coal Company has a tipple on the Ohio River just above the mouth of the Tradewater River. Coal is carried to this river tipple by rail and delivered to barges which float the coal down the Ohio and Mississippi Rivers to markets in the South. The Green River can also serve as a highway for the transportation of coal.

The characteristics of the Western Kentucky coal have already been described in detail in this report. It is a free burning coal and excellent for steam raising purposes. It is used extensively by the railroads, and for domestic fuel. Electric light and power companies burn this coal, and it is used in the manufacture of artificial gas. The principal markets are in Kentucky and the Southern States, but Western Kentucky coal is also sold in Ohio and a number of the Western States.

CHAPTER IX

CLAY MINING AND THE CLAY INDUSTRIES.

In the Western Coal Field proper, the geological formations from which clay and shale are secured for the clay products industries consist of: surface clay and loam which border streams; shales of the Allegheny series; white clay, often called "kaolin," which occurs in certain localities at the base of the Pottsville formation; and possibly some clay shales of Pottsville age.

The development of the clay products industry in the individual counties of the Western Coal Field is as follows.

At Owensboro, Daviess County, beside the Louisville, Henderson & St. Louis Railroad, are located the two plants of the Owensboro Sewer Pipe Company. The main plant which was in active operation when visited in August 1923, is shown in Plate XXXIX. The second plant is operated only occasionally. The fire clay shale used is mined underground at Hawesville, Hancock County, and Lamkin. Each of these beds of shale is overlain by eighteen inches of coal. The clay shale is crushed, screened, tempered in wet pans and sent to the pipe press where

PLATE XXXIX. PLANT OF THE OWENSBORO SEWER PIPE COMPANY, OWENSBORO.

it is manufactured into sewer-pipe. Special portions of the pipe are molded by hand. Firing is performed in ten circular, down draft kilns. Four car loads of sewer-pipe are made per day. The sewer-pipe which is shipped to Louisville and Henderson goes over the Louisville, Henderson & St. Louis Railroad, while that destined for points as far south as the Gulf goes over the Louisville, Henderson & St. Louis Railroad to the Illinois Central and Louisville & Nashville systems, thence southward. A market is also found in eastern and central Kentucky. Some pipe is shipped by Ohio River boats to Rockport but the river is used only to a slight extent.

One mile south of Owensboro is the S. B. McCullough brick works. A clay of the Ohio flood plain is dug. A stiff-mud machine is used. The product is common brick.

Ten miles south of Owensboro at Moseleyville is a drain-tile plant operated by the Clark Manufacturing Company. The clay used is found bordering a stream and is probably an alluvial deposit (Ref. 75:70). The plant is equipped with a stiff-mud machine, two-story drying sheds and three circular down-draft kilns.

At Henderson, Henderson County, the firm of Kleymeyer and Klutey operate a drain-tile plant and a common brick plant. The clay is excavated from deposits near the works. The drain-tile plant has three circular down-draft kilns. The brick plant is equipped with a soft-mud machine, tunnel driers, two Dutch kilns and two up-draft closed rectangular kilns of 130,000 capacity each. A good red brick is made (Ref. 75:88, 89).

At Madisonville, Hopkins County, is the W. L. Hall brick plant. It is located on a coal switch of the Louisville & Nashville Railroad. A partially weathered clay shale of yellow and reddish color is used, which fires to a red color. Also a bluish clay shale is obtained near the bottom of the pit where the beds are less weathered and harder. The bluish shale, termed "fire-clay," which is taken from one of the pits, fires to a buff color. Dutch kilns are used. Common brick, face brick and low grade fire brick are made.

The Madisonville Drain Tile Company, Plate XL, is located on the eastern outskirts of Madisonville. The clay is obtained in a field adjacent to the plant. The soil is stripped off and the underlying weathered Pennsylvanian clay shale is plowed up and transported to the plant by means of a scraper operated by a cable. The clay is sent through a rolls and pug-mill and then into a stiff-mud machine. The hollow block and drain-tile are then dried. They are fired in two circular down-draft kilns.

PLATE XL. THE MADISONVILLE DRAIN TILE COMPANY, MADISONVILLE.

In Muhlenberg County one-half mile northeast of Central City on the Illinois Central Railroad, (Ref. 75:100) is the plant of the Central City Brick Company. The clay used, probably of residual origin, is hauled to the plant in wagons. Dry-pressed common brick are made for the local market. Two Dutch kilns are used.

At Sturgis, Union County, is the Quinwin Brick and Tile Company. The clay is excavated near the plant. H. Reis states (Ref. 75:102) that this clay may represent a high terrace deposit of the Tradewater River. Drilling has shown this clay to be 30 feet in depth. Molding is performed in a stiff-mud machine. There are two circular down-draft kilns. Building brick and drain-tile are made.

At Uniontown, Union County, is the Alhorn and Waller drain-tile plant. The clay was doubtless deposited from the Ohio River. The clay is hauled by wagons from the pit to the plant which is near by. There are one rectangular and one circular kiln.

The Henshaw Brick and Tile Company is located at Henshaw, Union County (Ref. 75:104).

Two miles east of Sebree, Webster County, on the Green River, is the clay products plant of U. S. Bishop and Sons. The clay is a flood-plain deposit. A stiff-mud machine and two circular down-draft kilns are used. Drain-tile, hollow block and common brick are made. They are sometimes shipped to market by boat on the Green River.

The Providence Brick Company, Providence, Webster County, has a plant beside the Louisville & Nashville Railroad, a short distance east of the city. The clay is obtained near the works and molded in a dry-press machine. Common brick are made.

At Ashbyburg, Webster County, the Clark Manufacturing Company has a plant beside the Green River. A flood-plain clay deposit is dug. A stiff-mud machine and three circular down-draft kilns are used. The common brick, drain-tile and hollow blocks which are made, are sold locally and shipped by boat on the Green River.

There are many other locations within the Western Coal Field where clay products plants can be successfully located. Among the conditions necessary to success are: an abundant supply of excellent, uniform quality shale or clay; easy, economical mining; ready, cheap transportation by rail or water to large nearby markets. Fuel should be plentiful and inexpensive. Common and skilled labor should be obtainable at reasonable wages. Plants making a product of higher value per pound can ship to more distant markets than those manufacturing a heavier, cheaper ware. Small brick and tile plants might successfully supply the local demand, if they could make an excellent product that could sell as cheaply or even at a less price than similar products shipped in from the larger plants located at a distance.

CHAPTER X

CITIES AND MANUFACTURES.

The Western Coal Field contains numerous country stores, villages, towns and seven cities.

The small country store is often located at the intersection of the more frequented roads. These stores sell goods of all kinds. Where the roads are poor and distant from a railroad, the country stores occur at shorter intervals because the citizens cannot readily travel far to reach a store. Improved roads enable the country people to go a greater distance to larger stores in some neighboring town. A few houses sometimes have been built at the cross-roads along with the store.

Small towns are also situated at the intersection of highways. They have a central location in a small or large area depending on the condition of the roads. If a railroad passes through the town it aids in the commercial growth of the town.

Mineral springs have aided the growth of a few towns. Many small villages and towns owe their existence to nearby coal mines. Examples are Clay and Wheatcroft in Webster County. Railroad junctions have been beneficial to towns where they occur. Nortonville, Hopkins County, is a railroad junction as well as having coal mines. Livermore, McLean County, is located at the union of the Rough and Green Rivers in addition to being on a railroad. Logs floated down these rivers are used at the two chair manufacturers located in this town. Several towns which were formerly Ohio River ports before the present development of railroads, have ceased to grow or have decreased in population. Thus Uniontown on the Ohio River used to have considerable business. In 1860 the population was 1,046, while in 1920 it was 1,096. With decline in river traffic, the town's commercial activity began to wane. Improvements in the channel of the Ohio River which will stimulate navigation, should aid Uniontown to some extent. Coal mining, at present, is helping to keep up the prosperity of the town.

County seats are often located near the center of the county, examples being Morganfield, Union County; Hartford, Ohio

County; Greenville, Muhlenberg County; Dixon, Webster County and others as shown on the map, Figure 1. A few county seats are found in the most important cities. Thus Hawesville, Hancock County; Owensboro, Daviess County; and Henderson, Henderson County, are all located along the Ohio River on the northern edge of their respective counties. Many of the towns owe their existence to the fact that they are county seats and also trade centers for the surrounding agricultural districts. An example is Dixon, the county seat of Webster County, which depends upon its political and farming interests. There are no coal mines in the vicinity of Dixon, the coal seams in this locality being over 1,000 feet beneath the surface. Many people use such towns solely for residental purposes. They are often people of wealth interested in coal mines or other industries.

In towns where the court house was built during the earlier development of the place, the court house square forms the nucleus of the business section which has been built outward from this center. The court house is always surrounded by a green lawn which is frequently shaded by beautiful trees, Plate XLI. In some of the large cities, such as Owensboro, the city hall, or municipal building also presents a handsome appearance. Some of the larger county seats are important industrial, mining and commercial centers, and would be flourishing cities even though the county government were located elsewhere. Such county seats are Owensboro, Henderson and Madisonville.

Cities of the Western Coal Field are Owensboro, Henderson, Madisonville, Providence, Earlington, Central City, and Morganfield.

OWENSBORO.

Owensboro, the county seat of Daviess County, extends along the top of the high bank of the Ohio and spreads southward over the level plain that borders the river. In pioneer days it was known as the "Big Yellow Banks" because of the yellow color of the river bank. It was seldom called by any other name than "Yellow Banks," until 1839 or 1840. In 1812 the only habitations were a cabin and store. (Ref. 39:321). The site was chosen for the county seat in 1815 and the first real name given the settlement was Rossborough. The village was incorporated February 3, 1817. In April 1818 the name was changed to Owensboro in memory of Col. Abraham Owen who was killed at Tippecanoe. The village became an important river port. This was due in part to its strategic location. Owensboro is situated on the most southernly portion of the Ohio's meandering course along the northern boundary of Kentucky, before the river finally turns southward on its last comparatively short stretch to the Mississippi. Thus Owensboro with its river traffic is brought nearer to all portions of Kentucky directly south of the town, than any other point along the Ohio east of Mt. Vernon. Naturally this advantageous position stimulated

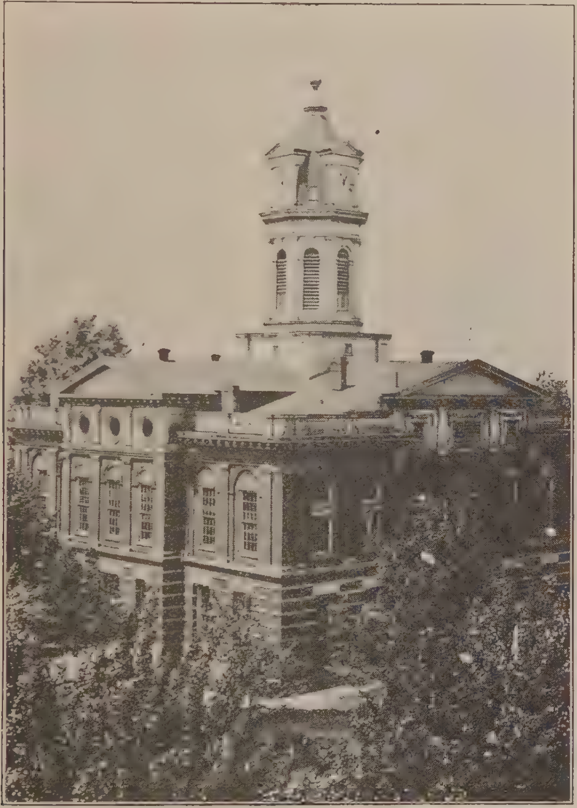

PLATE XLI. COUNTY COURT HOUSE, OWENSBORO, DAVIESS COUNTY.

the transfer of goods at Owensboro from land to water and vice versa. As the hinterland became more settled commerce grew and with it the town. Later, railroads absorbed a great share of the river traffic but they also aided Owensboro, and its development continued.

At present, Owensboro has three railroads, the Louisville & Nashville, Illinois Central, and the Louisville, Henderson & St. Louis. The shipping facilities thus afforded are excellent. The large markets of Louisville, Cincinnati and other cities are quite near. Some industries do a foreign export business. The Ohio River traffic, although comparatively small, may increase after the dam and lock improvements now being constructed by the Federal government have been completed. These projects will increase the depth of the water above the dams so that large boats can navigate even during low water. The river traffic should make the railroad freight charges lower than they otherwise would be.

Owensboro ranks second among the manufacturing cities of Kentucky. It is in the Western Coal Field of Kentucky, coal being mined in the Bon Harbor Hills near the city. Industries have an abundant supply of coal for fuel. The farming region in which this city is located is very rich. Tobacco, corn and live stock are important agricultural products.

In 1833, the population of Owensboro was about 200. The increase was small until 1850. In 1870 the population was about 3,437; January 1873, 5,500; 1890, 9,837; 1900, 13,189; 1910, 16,011; 1920, 17,424 (Ref. 14, v. II: 152; 13).

The Owensboro of today, is a beautiful, modern commercial and manufacturing city, Plate XLII. The business section extends outward from the county court house. The streets are broad, clean and shaded by trees. There are thirteen miles of asphalt, thirteen miles of improved macadam and thirty-five miles of cinder streets. Trolley lines total 11.89 miles in length. Even in time of flood the Ohio River comes only a short distance up into the streets bordering the river. This is because the flats upon which the city is built rise high above the normal water level of the river. Where the boats land their cargoes, the face of the bank is paved with stone blocks. Riverside Park extends along the top of the bank on the upstream side of the boat landing. A long stretch of the beautiful Ohio, bordered on its further shore by a solid wall of green foliage, can be seen from this park. Other parks are American Legion Park and Chautauqua Park.

Owensboro has a fine public school system. There are nine graded public schools, including two for colored folk; high schools; two parochial schools, St. Francis Academy and St. Hubertus. There are a well-equipped City Hospital, a Carnegie Library, Plate XXX, five banks, numerous fine churches, a gospel mission, country club and golf links, theaters, Y. M. C. A., Y. W. C. A., K. of C., Clubs, and two daily newspapers. Owensboro owns its own water and light plants which are valued at more than $2,000,000. The water is obtained from deep wells and is rated as "good," by F. C. Dugan, Director of the State Bureau of Sanitary Engineering.

Owensboro, as previously stated, ranks second among the manufacturing cities of Kentucky. The principal industries are as follows:

The tobacco industry includes a factory of the American Cigar Company and twelve tobacco companies' warehouses.

The F. A. Ames Company and the Ames Body Corporation have large plants at Owensboro. The Ames Body Corporation has a dimension mill and a finishing mill. They manufacture

PLATE XLII. IN THE BUSINESS SECTION OF OWENSBORO.

automobile and carriage bodies which are then turned over to the F. A. Ames Company to paint and finish. This company also manufactures and assembles spring vehicles. The Ames Body Corporation buys rough lumber from sawmills in Daviess and adjacent counties. Cottonwood is imported from Mississippi mills, and poplar from various parts of Kentucky and Tennessee. The rough lumber is finished in the company's own mills. The steel used is brought in automobile body sheets, mostly from Pennsylvania mills. Power is obtained, primarily, from coal. The F. A. Ames Company sells buggies and spring wagons throughout the Southern States. Some spring wagons are exported to Mexico.

The Owensboro Forging Company manufactures carriage forgings. Iron bar stock is purchased from Pennsylvania and Ohio mills. The location of this plant at Owensboro is influenced by the great development of carriage manufacturing in this city, the drop forgings being sold to the carriage manufacturers.

The Owensboro Wagon Company and the Owensboro Wheel Company are two other important industries.

The Anglo-American Mills manufacture grain cleaning machinery, packers, the Midget Marvel flour mill, Marvel corn mill and the like. The gray iron castings used are secured in Owensboro and the steel entering into their products is imported from outside the county.

Other manufacturers of machinery are the Owensboro Ditcher and Grader Company, and the Wright Machine Company.

The Murphy Chair Company is an important industry.

The D. C. Stimson Lumber Company ships logs by rail to the mill at Owensboro. Some logs are hauled in by team. Large logs are obtained in Daviess and other counties. They are sawed into rough lumber which is sold to planing mills and furniture manufacturers. There are five planing mills in Owensboro. Rough lumber is brought by rail from Kentucky, Louisiana, Mississippi, Georgia and other Southern States. It is planed and worked into doors, window frames and the like. Red cedar shingles are brought from the Pacific coast and resold at Owensboro.

Other industries in Owensboro are three soft drink bottling works, flour and corn mills, meat packing company, conserve and canning company, seven or more wholesale grocery companies, stock food mills, bakery, grain company, electric lamp factory, portable vise stand works, artificial ice and cold storage plants, gas works, three distilleries (not operating), concrete products, sewer pipe and brick plants, and a broom factory. Coal mining is carried on in the Bon Harbor Hills near Owensboro.

Manufacturing is steadily increasing in Owensboro, as shown in Table 37. In 1914 the total value of products manufactured in Owensboro was $4,056,142, in 1919, $8,634,737.

The continued growth and prosperity of Owensboro is assured.

HENDERSON.

Henderson, the county seat of Henderson County and the second largest city in the Western Coal Field, is located on the bank of the Ohio River. It was incorporated in 1790. The plain of the Ohio on which the city is built, is so high that in time of flood the water cannot do any damage to the city, Plate XLIII.

Commercially and industrially the city is strategically situated. It is on the most southernly curve of the Ohio since the stream passed Owensboro. The commercial advantages thus obtained are similar to those already described in the discussion of Owensboro. Henderson is also favorably situated with respect to larger city markets. The distance from Henderson to Chicago is about 299 miles, St. Louis 166 miles, Nashville 144 miles, Louisville 142 miles and Cincinnati 250 miles (Ref. 34). Evansville is only a few miles away and many other cities within easy reach. In the earlier days Henderson was an important river port but with the development of railroads the river traffic decreased. The railroads, however, aided the town to grow industrially.

At present the railroads serving Henderson are: the Louisville & Nashville, the Illinois Central, the Louisville, Henderson & St. Louis. Connections are made with other lines for points throughout the East and West. Railroads cross the Ohio

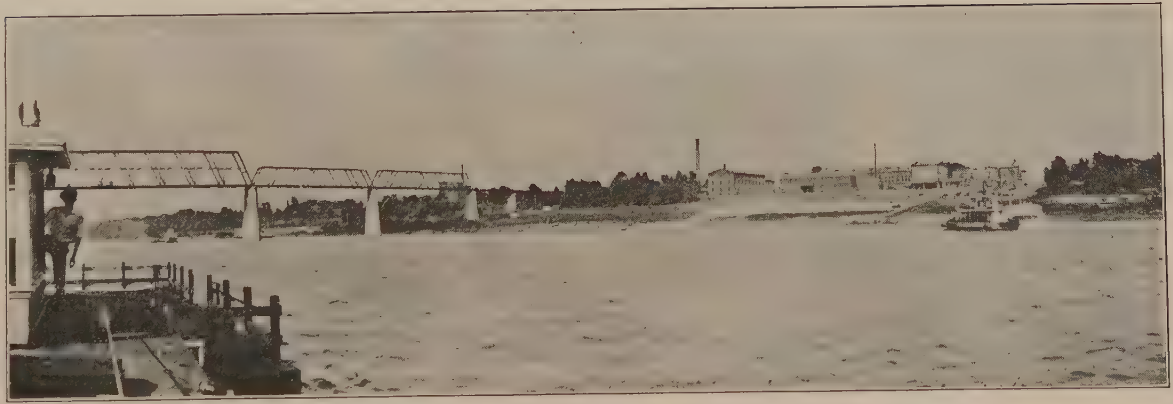

PLATE XLIII. HENDERSON CITY AS VIEWED FROM THE OHIO RIVER.
Photo furnished by courtesy of the Henderson Chamber of Commerce.

PLATE XLIV. PLANT OF THE ECKERT MEAT COMPANY, HENDERSON CITY.
Photo furnished by courtesy of the Henderson Chamber of Commerce.

River at Henderson over a magnificent bridge, Plate XXXVI. On the Ohio River there are packet lines, and goods can be shipped to Louisville, Cairo, Cincinnati, Pittsburg, New Orleans, and into Kentucky, via packets on the Tennessee, Cumberland, Green and Wabash Rivers.

The region adjacent to Henderson is rich agriculturally and in its coal resources. Coal mines occur within the city limits. Coal can be delivered cheaply to industrial plants at Henderson.

Due to these favorable factors the population and industrial activity of Henderson has increased steadily. The population in 1890 was 8,835; 1900, 10,272; 1910, 11,452; 1920, 12,169 (Ref. 13).

Henderson has handsome churches, banks, library, Y. M. C. A., schools and other public buildings, and residences. The city owns and operates its own electric power, electric light, water and gas plants. The water supply is excellent and the water on leaving the fine water works plant, is pure. Henderson is also up-to-date in its well kept streets about twelve miles of which are paved, four large parks, County Club and two golf courses, theatres and two daily papers. The principal industries of Henderson are as follows: The Consolidated Textile Corporation Mills; eight or more tobacco companies' warehouses; several coal mines, three being within the city limits, Plate XXXVII; a box and basket plant which uses local timber and wood shipped in from a distance; several buggy and furniture factories, which at first used local wood but now import most of their material including iron and steel parts, and wheels; a grain elevator; flour mill; stock yard; excelsior company; meat packing plant, Plate XLIV; sand and gravel company which digs the material from the Ohio River and its banks; planing mill; brick yard; concrete works, and the H. J. Heinz tomato ketchup works. This last industry buys tomatoes which are raised locally and also ships in tomatoes from Indiana. The reason more farmers in Henderson County do not raise tomatoes, is that they believe they can make more money planting tobacco than can be obtained from tomatoes.

The total value of the products manufactured in Henderson in 1914 was $2,973,457 and in 1919, $4,765,359.

With the many natural advantages that it possesses, Henderson's industrial and commercial future is very bright.

MADISONVILLE.

Madisonville, the county seat of Hopkins County, was named after President Madison. It was incorporated in 1807. Commercially, the city is advantageously located in the heart of the Western Coal Field. The Louisville & Nashville Railroad which extends from Henderson to Hopkinsville passes through Madisonville. This city is also served by an east and west line of the Louisville & Nashville. A short distance to the south at Nortonville, the Illinois Central Railroad crosses the Louisville & Nashville line from Madisonville. The Illinois Central which in general stretches east and west, is building, in 1923, a railroad, Plate XXXV, that will run from Central City through Madisonville to Dawson Springs where it will join the main line of the Illinois Central from Muhlenberg County.

PLATE XLV. A BUSINESS STREET IN MADISONVILLE.

The natural resources include extensive coal seams, deposits of good building stone, clay shale, limestone for road metal and the manufacture of lime, and rich agricultural lands on which tobacco, corn and live stock are raised.

Madisonville is a pretty city, Plate XLV, with its asphalt and macadamized streets, fine business section at the center of which is the county court house shown in Plate XLVI, electric lights, good hotels, fine residences, churches and the like. Electricity for lighting and power purposes is purchased by the city from the Kentucky Utilities Corporation, and is distributed and sold by the city.

PLATE XLVI. COUNTY COURT HOUSE AND CONFEDERATE MONUMENT, MADISONVILLE, HOPKINS COUNTY.

Industries in active operation in and near Madisonville include twelve large coal mines including one of the largest stripping operations in the State, drain tile and building block plant, brick yard, crushed limestone works, stone quarries, two planing mills, sawmills, two flour mills, ice plant, three bottling works, and an American Cigar Company factory which is located at Madisonville principally because of the labor supply. Girls are employed in making the cigars. They come from the families of coal miners and farmers in Hopkins County and are mostly native born. When the coal mines are working and the girls' parents are earning high wages, it is difficult to get enough girls to work in the factory, but when times are hard at the mines, there is a plentiful supply of girl labor. This makes the labor supply seasonal for with the mines operating in the winter and the roads bad, girl labor is scarce, but in the summer when opposite conditions occur, many girls seek work.

An oil field has been developed a few miles south of Madisonville on the Williams and Holloman lease.

The growth of Madisonville is shown by the following statistics of the U. S. Census: 1890, 2,212; 1900, 3,628; 1910, 4,966; 1920, 5,030. The city is very much alive and will continue to increase in population and prosperity.

PROVIDENCE.

Providence, located near the southern corner of Webster County, was incorporated February 18, 1840. It is served by the Louisville & Nashville, and Illinois Central Railroads.

The main business section is situated on the side and top of a hill which slopes down to the valley along which stretch the railroad lines. Residences are built on the hills and in the valleys. The city has asphalt streets, electric lights and other conveniences.

Providence has grown rapidly within recent years. The population in 1890 was 522; 1900, 1,286; 1910, 2,084; 1920, 4,151.

The chief industry is coal mining. There are many coal mines in or near the city. Tobacco is an important crop in the rural districts, and Providence which is a market for this product, has two tobacco warehouses. Other industries include a brick yard, two flour mills, ice plant, soft drink bottling works, and lumber yard.

EARLINGTON.

This city is only a few miles south of Madisonville, Hopkins County. The business section is in a valley beside the Louisville & Nashville Railroad which serves the city. The principal streets are to be surfaced with asphalt.

The principal industry is coal mining. Offices, and power plant, Plate XLVII, of the St. Bernard Mining Company are located here. There are also the Louisville & Nashville Railroad shops, a flour mill and ice plant.

The growth of Earlington has been as follows: 1890, 1,748; 1900, 3,012; 1910, 3,931; 1920, 3,652.

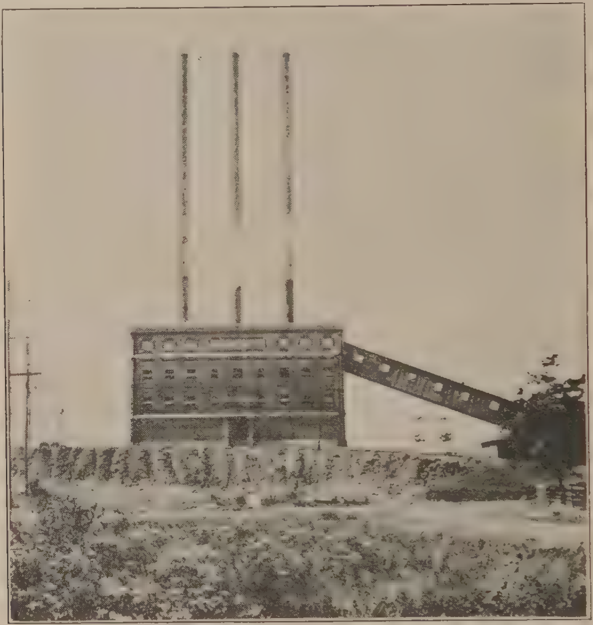

PLATE XLVII. POWER PLANT OF THE ST. BERNARD MINING COMPANY, EARLINGTON, HOPKINS COUNTY. AUG. 1923.

Central City.

This city is located in the northeastern part of Muhlenberg County. It is at the junction of the Illinois Central Railroad which runs, in general, northeast-southwest, and the north-south line of the Louisville & Nashville.

The business section of Central City is in the valley adjacent to the railroads. The principal streets, Plate XLVIII, were torn up during August 1923, preparatory to being paved.

Coal mining is the chief industry, several mines being in and near the city, Plate XI. Railroad yards of the Illinois Central are at Central City. Other industries include a grist mill, two planing mills, brick yard, and smaller establishments.

The population of Central City in 1890 was 1,144; 1900, 1,348; 1910, 2,545; 1920, 3,108.

PLATE XLVIII. THE BUSINESS SECTION OF CENTRAL CITY, MUHLENBERG COUNTY.

MORGANFIELD.

Morganfield is located in the central part of Union County of which it is the county seat. It was named after Gen. Morgan of the Revolutionary Army. The town was incorporated February 22, 1860. It is served by the Illinois Central, and the Louisville & Nashville Railroads. The Illinois Central from Henderson passes through the town.

The business section extends outward from the county court house. The streets are paved with brick and asphalt. Electricity with which the town is lighted, is brought to Morganfield.

Morganfield in addition to being the county seat, is a trade center for the surrounding rich agricultural districts. There are also two coal mines near the business section, one of which is shown in Plate XII, and a third three miles from town, an ice plant, flour mill, two grain elevators, and one receiving station for loose leaf, dark tobacco.

The population of Morganfield in 1890 was 1,094; 1900, 2,046; 1910, 2,725; 1920, 2,651.

CHAPTER XI

POPULATION AND WEALTH.

POPULATION.

The density of total population per square mile in the Western Coal Field, increased until in 1900 it equaled 53.4; 1910, 55.5; 1920, 54.9, as against the State average for these years of 53.4, 57.0 and 60.1.

If incorporated towns with a population of 2,500 or more are deducted, the density of rural population per square mile in the Western Coal Field, is as follows: 1900, 47.2; 1910, 47.0; 1920, 45.0, as compared to a State average of 41.7, 43.2 and 44.3. The rural population of the Western Coal Field is greater per square mile than the State average because of the coal mining industry in many of the counties. In counties where there are not as many men employed at the coal mines, the density of the rural population is less than in counties containing a better development of the coal industry. Counties with rougher topography and few, if any, railroad lines, have also a smaller population per square mile than counties with smoother surface and better transportation facilities.

From 1910 to 1920 the rural population declined, with but three exceptions, in those counties that during this period suffered a net loss of cultivable acreage. Exceptions to this relationship were due to increase of rural population in the coal mining districts even when the net cultivable acreage decreased, and decrease in rural population through the greater use of farm machinery even when the net cultivable acreage increased.

Comparison of the density of total population and of rural population shows that the total population, including the cities, increased from 1900 to 1910, 2.1 persons per square mile; but from 1910 to 1920, the total population decreased 0.6 person per square mile. From 1900 to 1910 the rural population decreased 0.2 person, and from 1910 to 1920, decreased 2.0 persons per square mile. Thus the rural population decreased more rapidly than the total population, which shows that the people of the

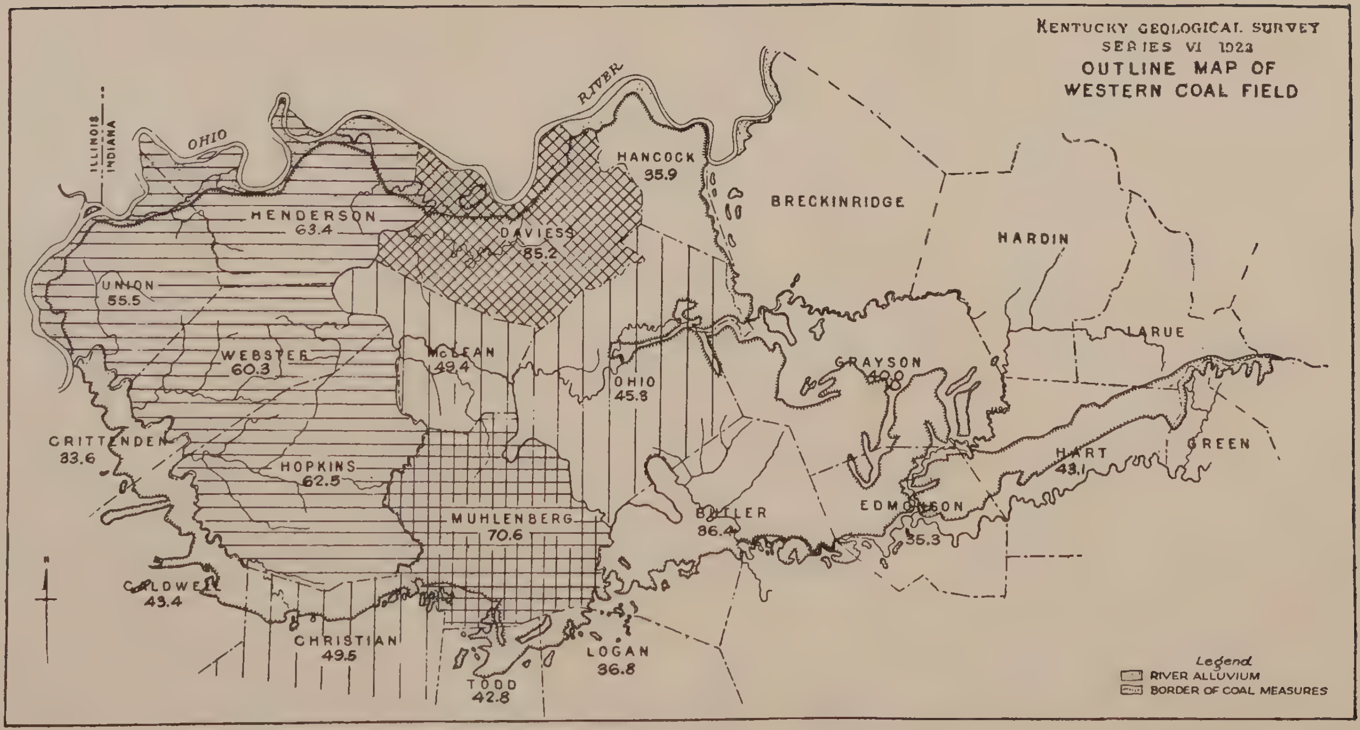

FIG. 18. DENSITY OF TOTAL POPULATION.

Number of inhabitants per square mile of area. Explanation: Blank represents 30-45 persons; vertical lines, 45-55 persons; horizontal lines, 55-65 persons; squares, 65-75 persons; diamonds, over 75 persons.

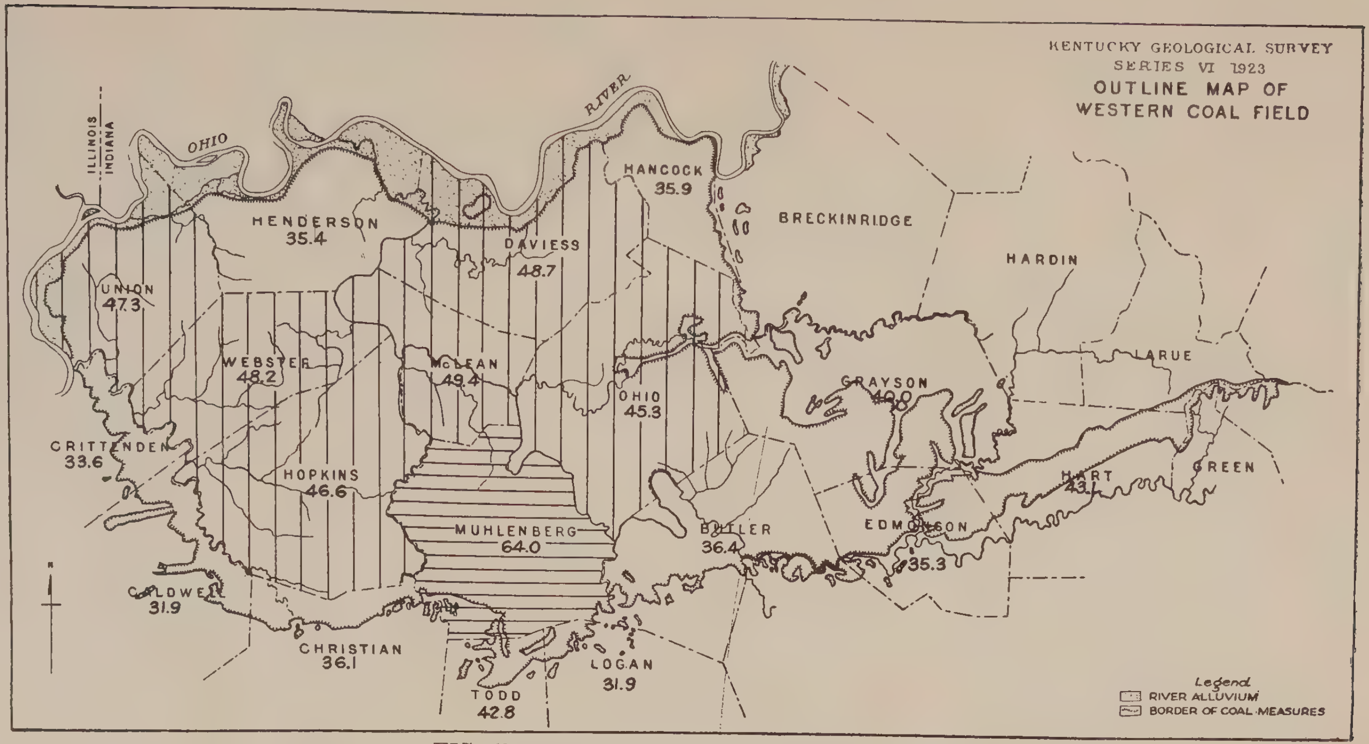

FIG. 19. DENSITY OF RURAL POPULATION.

Number of inhabitants per square mile of area. Explanation: Blank represents 30–45 persons; vertical lines, 45–55 persons; horizontal lines, 55–65 persons.

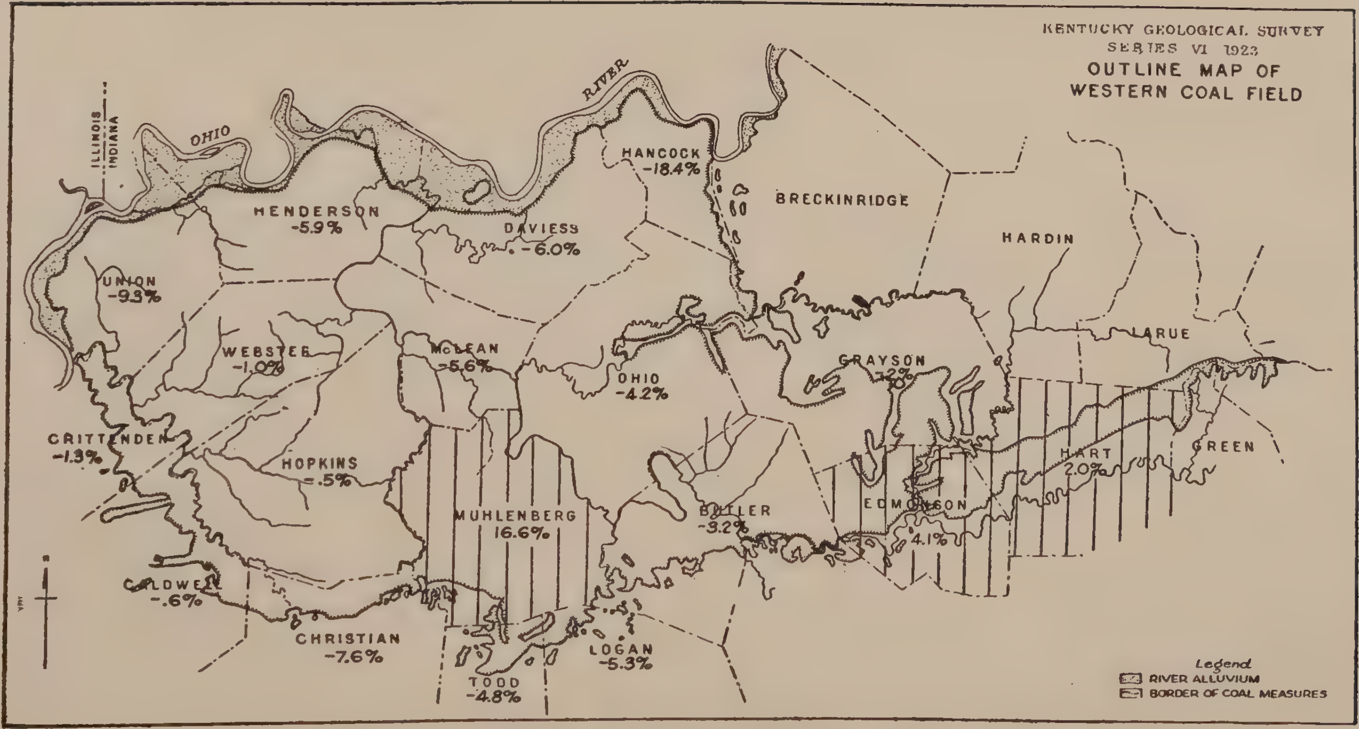

FIG. 20. PER CENT OF INCREASE OR DECREASE OF TOTAL POPULATION, 1910-1920.
Explanation: Blank represents decrease; vertical lines, inscreae.

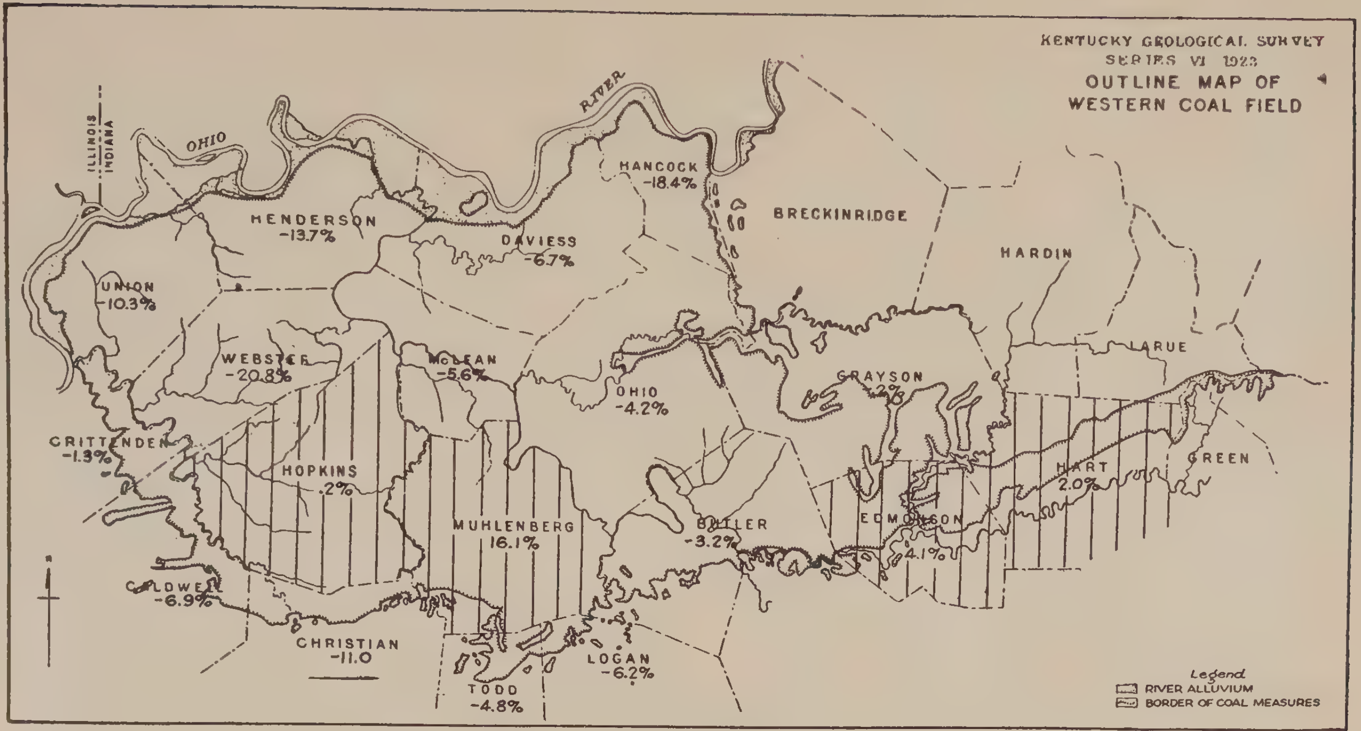

FIG. 21. PER CENT OF INCREASE OR DECREASE OF RURAL POPULATION, 1910-1920.
Explanation: Blank represents decrease; vertical lines increase.

rural districts were gradually leaving the country for the cities of Kentucky, or moving into other States. Cities during these decades increased in population.

People have left the farms and moved to the cities for the following reasons: isolation, monotony and hardships of farm life; low wages on the farm compared to those obtainable in the city; decreasing fertility of the farm land; farmer's income variable, small and uncertain, whereas in the city the reverse is true; better educational facilities in the city.

Some of the drawbacks to farm life are at present being overcome. The United States Rural Mail Delivery is bringing the farmer into contact with the outside world. Telephones and automobiles are shortening the distances between farms, and farms and cities or villages. Better roads are continuing to make farm life more pleasant and economical, and enable the children to go to school. Better farming methods are giving a higher net profit from the land. Radiophones are bringing entertainment to the most isolated homes.

The per cent of native whites, foreign-born whites and negroes in the Western Coal Field at present is influenced by the geology and geography of the region. Areas of rough topography, little or no commercial coal mining and poor communication with the outside world, rank highest in the per cent of native whites. Thus the population of Butler County in 1920 was 96.9 per cent native white; Edmonson 96.6 per cent; Grayson 98.7 per cent. On the other hand counties having more ready communication with the outside world, commercial coal mining using white and colored workers, and agriculture that employs foreign-born or negro labor, have populations composed of a slightly lower per cent of native whites. Daviess County is an example. It borders the Ohio River and has excellent railroad facilities in addition to its river traffic. Tobacco is an important crop. Negro as well as white labor is employed in its production. Coal mining is carried on. Owensboro, the same as other cities, attracts negro residents. The result was that in 1920. 88.3 per cent of the population of Daviess County was native white, a decline in the percentage of native whites as compared with the isolated, more mountainous counties referred to above. Henderson County with geographic and life conditions similar to Daviess, had 78.4 per cent native white. In counties where coal mining is highly developed, the percentage of native white is lower than it otherwise would be under existing geographic conditions, due chiefly to negro labor employed at the coal mines. In some of the mining towns or camps, the houses along entire streets are occupied by negro families. The farming population throughout the Western Coal Field is chiefly native white, but negroes work some of the farms as owners or tenants. The native whites of foreign-born or mixed parentage are found mostly in the counties having ready communication with the outside world. They are few in number, however, compared to the native whites of native parentage.

The number of foreign-born whites is very small in proportion to the total population in each of the Western Coal Field counties. Daviess and Henderson counties which border the Ohio River and are in ready touch with the outside world have 0.6 and 0.9 per cent, respectively, of their population foreign-born white. In comparison the more mountainous and isolated counties have almost no foreign-born whites, Butler County in 1920 having less than 0.1 per cent, Edmonson 0.1 per cent, and Grayson 0.1 per cent.

The negro population is found in greater numbers in the cities, where the negroes are employed chiefly for manual labor, domestic service and odd jobs; at the coal mines and in the more level counties where they live as tenants and are employed as hired labor on the larger farms. The negro will often have bought a farm of his own, especially in the tobacco growing regions. In the rougher surfaced areas with their smaller farms which are worked by the white owner, the negro forms a very small part of the total population. Thus Daviess County in 1920 had 11.1 per cent of its population colored, Henderson 20.6, Hopkins 17.7, Union 12.2 and Webster 14.1 per cent. In contrast Butler County had only 3.1 per cent of its population negroes, Edmonson 3.3, and Grayson 1.2. The few colored folk in the more mountainous counties decreased quite rapidly in numbers from 1910 to 1920. Edmonson County had 4.2 per cent of its total population negroes in 1910 and 3.3 per cent in 1920. The average per cent of negroes in the Western Coal Field as a whole decreased from 11.3 to 10.2 during the decade.

If this decrease of the negro population continues uniformly and there is no increase by immigration or increased birth rate, the colored race will ultimately disappear throughout most of the Western Coal Field.

In 1910 the Western Coal Field as a whole, had a total population of 88.2 per cent native white, 0.5 per cent foreign-born white and 11.3 per cent negro. In 1920 there were 89.5 per cent native white, 0.3 per cent foreign-born white and 10.2 per cent negro. The State averages in 1910 and 1920 were 86.8 per cent and 89.0 per cent native white, 1.7 per cent and 1.3 per cent foreign-born white, 11.4 per cent and 9.8 per cent negro. The per cent of native whites is increasing in the Western Coal Field and the State as a whole, while the foreign-born whites and negroes are decreasing in proportion to the total population.

WEALTH.

Among the counties of the Western Coal Field in 1920, Daviess ranked first with a total taxable wealth of $38,164,204 and a taxable wealth per square mile of $79,841. Henderson County came second with a total taxable wealth of $28,432,992 and a taxable wealth per square mile of $65,363. Similar data for the remaining counties of the Western Coal Field may be found in Table 40. The total taxable wealth for the Western Coal Field as a whole was $161,516,989, the taxable wealth per square mile being $33,288. The total taxable wealth of Kentucky as a whole was $2,438,612,499, and $60,690 per square mile.

Among the Western Coal Field counties during 1920, Union led in taxable wealth per capita with $1,129.83; Henderson County coming second with $1,029.84. The per capita wealth of each county is given in Table 40. The taxable wealth per capita for the Western Coal Field as a whole in 1920, was $605.91 compared to a State average of $1,009.09.

The geologic and geographic control over the wealth of a county is shown in Table 40. Thus it is noted that counties with more rugged topography, poor or no railroad facilities within their boundaries and natural resources as yet mostly undeveloped, rank low in per capita wealth. Counties where great numbers of the population are employed at coal mines, and farming, as a whole, is not as important as in the more level counties, also have a lower per capita taxable wealth as compared to the per capita wealth of the level and gently rolling rich farming counties.

CHAPTER XII

SUMMARY AND CONCLUSION.

The geography of the Western Kentucky Coal Field has been described in detail in the preceding chapters. The main facts discussed and the various relationships between the geographic control and the life response will now be summed up briefly.

The Western Coal Field includes the area underlain by Pennsylvanian strata in Western Kentucky. It is bounded on the east and south by Mississippion formations and on the north and west by the Ohio River. The counties composing the Western Coal Field are shown in Figure 1. The Coal Measure strata have been preserved from erosion by being in a geosyncline on the west side of the Cincinnati Arch.

The principal streams flowing through the Coal Field are the Green and Tradewater Rivers, which empty into the Ohio River, and their tributaries. The Ohio River bounds the Coal Field on the north and west. Streams often form the county boundary lines. The Ohio River is the boundary between Kentucky and Indiana and Illinois.

The rougher surfaced areas are along the southern, and portions of the eastern borders. Northward and westward the Coal Field becomes more gently rolling as the Ohio is approached, except for a strip of hills that are formed where the streams leave the uplands for the Ohio River bottoms. The bottom lands along the Ohio are level and in places very wide. The stream valleys throughout the Coal Field except along the rough margin areas are often broad, flat and poorly drained. They are being aggraded by wash from the surrounding uplands. In the hilly districts the roads often follow the tops of the ridges.

The climate is humid, temperate and of the continental type. The Coal Field lies within the path of the moisture bearing storms which move from the Gulf northeastward to the Great Lake region and the North Atlantic coast. The temperature, precipitation, wind directions and the like have already been given in this report.

Residual and transported soils occur. Transported soils are found chiefly in the stream bottom lands where they have been transported by running water. Loess covers large areas of the uplands in Union, Henderson and other counties along the Ohio River. Unless protected by cover crops, soils which have been under cultivation will wash readily even on moderately steep slopes. The steep slopes should be kept in forest. The swampy lands are being drained in Daviess and other counties. They are then valuable for agricultural purposes. Correct rotation of crops and scientific farm management should be practiced if the soil is to retain its fertility.

Coal is the greatest natural resource. Seams Nos. 9 and 11 are the most important coal beds mined. Large quantities of shale occur which are suitable for the manufacture of brick, tile and similar products. Sandstone and limestone suitable for building stone are quarried in several different regions. Limestone is quarried and prepared for road metal and agricultural lime. Certain limestone might be used in Portland cement. Gravel is dredged along the Ohio River and used for surfacing roads and other purposes. Glass sands occur in a number of localities. Oil and gas have been found, but much territory yet remains to be prospected. Oil shale of the Pennsylvanian system has been found but is of too low grade to compete with the Ohio shale of the Knobs. Rock asphalt is being quarried along the southern margin of the Coal Field. It is prepared to surface roads. Deposits of rock asphalt still await development along the southern and eastern borders of the Coal Field. Iron ore occurs, but is of too low grade to be of economic importance at the present time.

Drinking water can be obtained at shallow depths in the river bottom lands, but deep wells are safer from the standpoint of purity. Care should be taken that wells and springs do not become contaminated and contain typhoid germs. Mineral springs occur in certain localities. Towns and cities would be benefited if their water supplies were filtered and thoroughly purified at adequately equipped water works plants. Many cities and towns have plants of this type and the water they deliver to their citizens is pure.

Forests cover wide areas of the river bottom lands and steeper slopes of the uplands. The large trees have been mostly cut away but some virgin timber still remains and is now being cut, Plate XLIX. Many smaller trees are cut for use as mine props, ties and the like. Some of the coal mining companies have large acreages of forest land for this purpose. In general much of the cut-over land has been allowed to grow up into a jungle of second growth trees and underbrush. It would increase the wealth of the State if these cut-over lands were planted to good varieties of commercial trees and the forests cared for scientifically. Also if the steeper slopes were forested, the soil fertility would not be wasted as it is when the trees are cut away, the soil cultivated for a few years, then abandoned and the land ruined by erosion.

PLATE XLIX. LOGS FROM THE FORESTS OF OHIO COUNTY.
Scene at Hartford railroad station.

The wild animal life consists of the common birds, snakes, rabbits, squirrels, opossums, skunks, occasional foxes and other animals found elsewhere throughout Kentucky. The rivers contain fish.

Counties containing more gently rolling or level land in proportion to their total area than occurs in the hilly counties, have a lower per cent of unimproved land than is found in the rough surfaced counties. The unimproved land, exclusive of woodland, includes large areas of swampy territory and land ruined by erosion. Proper farming methods should be used to prevent further wastage of cultivable land by erosion. Thousands of acres of swampy land have been reclaimed by drainage ditches and thousands of acres yet remain to be changed by proper drainage into excellent farming land. Tile also will greatly benefit much of the soil.

Farms have increased in number and decreased in size (chiefly by subdivision) especially in the tobacco producing counties. A farmer by raising tobacco, provided the market price is good, can maintain the same standard of living on a small acreage that he maintained on a large acreage where general farming was practiced. Co-operative associations have been organized to market several different kinds of farm products. A greater number of tractors are used in the gently rolling and level counties than in those having a rough topography.

The per cent of increase of land values, in general, bears a relation to the increase in the number of farms. Topography influences the value of the land. Rugged counties with poorer soils and greater difficulties in farming and in reaching a market, have lower land values, other things being equal, than the more level counties. The per cent of increase in valuation of farm land has been greatest in counties which raise tobacco extensively or have large acreages of swampy land reclaimed by drainage projects. This is because the value of an acre of farm land depends chiefly upon the net earnings which can be secured from it. The increase in price of all farm products a few years ago caused farm land also to increase in price. When the business depression came, the decline in the value of farm land was greatest where products were raised which decreased in price to the greatest extent. Thus the tobacco and corn producing counties had their land values declined more than did the rough surfaced counties where these products are not raised so extensively. The assessed valuation on all farm property and incomes from gross crop returns were greater in the more level counties than in those having a rougher topography.

The principal crops grown are corn, tobacco and wheat. Oats, rye, barley, potatoes and sorghum are produced in smaller quantities. Sorghum is raised in greater amounts in districts remote from railroads where all of the necessities of life are produced as far as possible on the farm. Forage crops are raised most in the more level counties. Truck gardening is carried on principally near the large cities which furnish a market. This industry can be developed, more than it is at present, near the smaller cities and towns. As the larger cities increase in size market gardening should also increase near them. Small fruits and orchard fruits are raised throughout the Coal Field. Apples are of especial importance in Henderson County. The orchard industry can be increased in many localities throughout the Coal Field. Fruits of many kinds should be grown on every farm for home use.

Increase in the number of animals on the farms will prove beneficial to the soil fertility. Horses are decreasing and mules are increasing for reasons already stated. Dairy and beef cattle are found in greater numbers in the more level counties which have a greater abundance of forage crops than in the rougher surfaced areas. Cattle are increasing in numbers. Whole milk is produced in greatest quantities near the cities. Cream, butter, and cheese can be produced further from markets if transportation facilities are adequate. The sheep industry has declined, due, in great part, to difficulty in protecting the sheep. The topography, however, is suitable for the profitable production of mutton and wool. Swine are fattened in greater numbers in the more level counties which produce heavy yields of corn per square mile. Many of the hogs are killed in packing houses in Owensboro and Henderson. The poultry industry is increasing and should prove profitable. Bees are kept successfully in rough as well as level topography. Sweet clover would greatly aid the bees and also benefit the soil. Poultry products and honey can be produced economically in the more remote districts and shipped to market.

The Western Coal Field was inhabited in prehistoric times by an unknown race called the Mound Builders. Relics of their existence are found in various parts of Kentucky. At present the level and rolling areas are dotted with well kept farms and farm buildings. Near the large towns the roads are piked. In the rugged areas log cabins and box houses are found as well as larger houses. The roads are often narrow and poorly kept. Many of the mining towns and camps are composed of regularly spaced, neatly painted houses. On the outskirts of some camps may be seen shacks where a floating population live. Everywhere better roads will benefit the citizens in the many ways already described. Even as it is, the Rural Mail Service has brought the most remote areas into contact with the events of the outside world.

Illiteracy exists in all of the counties, but the more hilly regions have a higher per cent of illiteracy than the more level counties with their better roads. The condition of the dirt roads in winter influences the dates of beginning and closing of the rural school year. High schools, academies, business colleges and institutions of higher learning are located in many of the towns.

Health conditions can be greatly improved, especially with respect to typhoid fever which is spread through the use of impure drinking water. A detailed discussion of various diseases has already been given.

Tenancy is more customary in the more level, tobacco producing areas than in the rougher surfaced districts. Native white farmers are increasing in numbers. Foreign-born and negro farmers are decreasing. Nearly all of the farmers in the more mountainous areas are native white. Many of their ancestors came from Virginia and North Carolina in pioneer days. More foreign-born whites are found in the Ohio River counties which are more readily accessible to the outside world, than in the more isolated, hilly counties. In the agricultural districts negroes are found in greatest numbers where tobacco is raised and on the larger farms as hired labor or tenants. They also flock to the cities. The negro population as a whole is decreasing steadily.

The Western Coal Field is well served by railroads throughout the important agricultural and coal mining districts. Butler, Edmonson and certain areas in other counties are badly in need of railroad transportation. The railroads generally follow the valleys and tunnel through any hill they encounter. The Coal Field is in touch by rail with Louisville, Evansville and other large cities and rural markets. The Ohio and Green Rivers with their dams and locks are navigable. Dams and locks are being constructed along the Ohio to facilitate navigation during periods of low water. Much of the river traffic of former days has been absorbed by the railroads, but when the improvements in the Ohio River channel are completed, river traffic should increase. The Tradewater River is too low during certain periods of the year to be navigable.

PLATE L. CRITTENDEN COUNTY TOPOGRAPHY ALONG THE TRADEWATER RIVER.

View from near Blackford. A camp meeting is seen in session in the distance.

The Western Coal Field contains the cities of Owensboro, Henderson, Madisonville, Providence, Earlington, Central City and Morganfield. Each of these cities has been described in detail.

The density of population in the Western Coal Field in 1920 was 54.9 per square mile. The rural population has moved away to a small extent from the farms to the cities during the last decade. Continued loss of many of the more progressive of the younger generation from the farms, will eventually have a serious effect upon the prosperity of the State. Factors that have caused the young folks to leave the farms together with the remedies have been discussed in this report.

In 1920 Daviess County ranked first among the Western Coal Field counties in total taxable wealth, having an assessed valuation of $79,841 per square mile. Counties having large areas of level or rolling rich farming land or coal seams have a higher taxable wealth per square mile than do the hilly areas along the southern and eastern margins, and the swamp lands.

In conclusion it should be remembered that great areas of coal land, rock asphalt deposits, oil and gas pools and many other mineral resources remain undeveloped. The forest lands under scientific management will prove a source of enormous wealth. Live stock can be kept profitably on the farms in increased numbers. Poultry and bees will add to the farm income. Correct rotation of crops and care of the soils will increase the returns from the land. Fruit culture is really in its infancy as compared to the development that can take place. Near the towns and cities truck gradening can be increased. Better roads will prove of benefit to everyone in many ways. The cities, due to their natural resources and strategic positions, will continue to grow as industrial centers. The future of the Western Coal Field both socially and economically is very bright.

APPENDIX

TABLE 1.

PREVAILING WIND DIRECTION.*

Station	Length of Record Years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Beaver Dam	13	s	nw	s	s	s	s	s	s	s	n	s	nw	s
Earlington	16	sw	n	sw	s	s	sw	sw	sw	sw	sw	sw	n	sw
Owensboro	20	nw	nw	nw	s	sw	s	sw	s	s	se	nw	nw	nw

*All Climatological Data based on: Climatological Data, U. S Weather Bureau, Western Kentucky.

TABLE 2.

MEAN TEMPERATURE

(DEGREES F.)

Station	Length of Record Years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Beaver Dam	13	35.5	35.0	46.3	55.6	66.4	73.7	77.8	76.6	70.8	58.0	46.5	36.3	56.6
Earlington	22	35.8	34.8	47.3	56.8	67.5	75.3	78.6	76.6	71.3	59.2	47.8	37.2	57.4
Leitchfield	21	35.4	34.1	45.9	55.2	65.6	72.8	76.7	75.4	69.8	58.0	46.4	35.8	55.9
Owensboro	20	35.4	34.6	46.5	55.2	66.3	74.0	78.0	76.4	70.6	59.0	47.6	36.6	56.7

TABLE 3.

MEAN MAXIMUM TEMPERATURE

Station	Length of Record Years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Beaver Dam	13	45.5	45.2	57.3	67.8	78.8	86.1	89.8	88.9	84.5	72.5	59.2	42.6	68.4
Earlington	22	45.0	44.1	57.3	68.5	79.3	87.3	90.9	89.2	84.4	72.3	59.2	46.1	68.6
Leitchfield	21	44.0	43.1	55.6	66.1	76.8	83.4	87.3	86.1	81.0	69.8	57.0	44.3	66.2
Owensboro	20	43.9	42.8	56.0	65.5	76.8	84.4	88.3	86.4	81.2	70.2	57.6	44.6	66.5

MEAN MINIMUM TEMPERATURE

(DEGREES F.)

Station	Length of Record Years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Beaver Dam	13	25.5	24.8	35.3	43.5	53.9	61.3	65.8	64.2	57.2	43.6	33.8	27.0	44.7
Earlington	22	26.6	25.4	37.3	45.1	55.7	63.3	66.3	64.1	58.2	46.0	36.4	28.4	46.1
Leitchfield	21	26.7	25.1	36.2	44.2	54.4	62.2	66.1	64.8	58.5	46.2	35.9	27.4	45.6
Owensboro	20	27.0	26.5	37.0	44.9	55.8	63.7	67.8	66.4	60.0	47.9	37.5	28.7	46.9

TABLE 4.

HIGHEST TEMPERATURE

(DEGREES F.)

Station	Length of Record Years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Beaver Dam	13	75	78	90	90	103	108	105	104	103	93	83	73	108
Earlington	26	76	79	90	93	105	107	107	108	106	97	85	74	108
Leitchfield	20	72	73	87	90	93	103	103	102	99	89	80	69	103
Owensboro	20	73	73	89	92	94	102	103	100	101	90	80	71	103
LOWEST TEMPERATURE														
Beaver Dam	13	—20	—8	14	24	30	39	47	45	33	23	8	—5	—20
Earlington	26	—16	—28	5	22	32	40	48	42	32	24	7	—10	—28
Leitchfield	20	—16	—26	1	20	29	40	50	47	28	23	8	—11	—26
Owensboro	20	—17	—21	4	25	34	43	51	49	32	25	10	—11	—21

TABLE 5.

PROBABILITY OF KILLING FROST IN THE SPRING*

Station	County	Elevation, feet	Probable Latest Dates of Killing Frost in Spring and Percentage of Risk.					Actual Dates of Last Killing Frost in Spring.	
			Average Date Risk 50%	Risk 33⅓% or 1 year in 3	Risk 20% or 1 year in 5	Risk 10% or 1 year in 10	Risk 5% or 1 year in 20	Earliest Date on Record	Latest Date on Record
Earlington	Hopkins	420	Apr. 15	Apr. 19	Apr. 22	Apr. 26	Apr. 29	Mar. 29, 1913	May 1, 1908
Owensboro	Daviess	479	12	17	20	25	28	Mar. 26, 1912	May 2, 1907

*Watlz, F. J. Killing Frost and Length of the Growing Season in Varoius Sections of Kentucky. Ky. Agr. Exp. Station, Circular No. 19, p. 124.

TABLE 6.

PROBABILITY OF KILLING FROST IN THE FALL*

Station	Probable Earliest Dates of Killing Frost in Fall and Percentage of Risk.					Actual Dates of First Killing Frost in Fall.	
	Average Date Risk 50%	Risk 33⅓% or 1 year in 3	Risk 20% or 1 year in 5	Risk 10% or 1 year in 10	Risk 5% or 1 year in 20	Earliest Date on Record	Latest Date on Record
	Oct.	Oct.	Oct.	Oct.	Oct.		
Earlington	17	13	9	5	2	Sept. 30, 1899	Nov. 3, 1900
Owensboro	23	19	15	11	7	Sept. 30, 1899	Nov. 9, 1900

*Waltz, F. J. Killing Frost and Length of the Growing Season in Various Sections of Kentucky. Kentucky Agricultural Experiment Station, Lexington, Ky., Circular 19, p. 126.

TABLE 7.

LENGTH OF THE GROWING SEASON.*

Station	Probable Length 4 Years in 5.		Actual Lengths of Growing Season.			
	Practically Sure	Range of Probability	Longest on Record and Year		Shortest on Record and Year	
	Days	Days	Days	Year	Days	Year
Earlington	162	177 to 197	216	1913	153	1908
Owensboro	169	182 to 206	222	1912	163	1909

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*Waltz, F. J. Killing Frost and Length of the Growing Season in Various Sections of Kentucky. Kentucky Agricultural Experiment Station, Lexington, Ky., Circular 19, p. 128.

TABLE 8.

MEAN PRECIPITATION
(INCHES)

Station	Length of Record Years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Beaver Dam	14	4.55	3.61	3.80	3.89	3.88	3.45	4.35	3.27	2.62	2.44	2.94	4.06	42.86
Earlington	28	4.57	3.77	4.84	4.22	4.72	3.44	4.24	3.23	2.84	2.60	3.87	3.82	46.16
Leitchfield	22	4.63	3.71	4.67	4.06	4.12	4.02	4.11	3.56	3.60	2.46	3.86	4.81	47.61
Owensboro	21	4.51	3.25	4.78	4.10	3.84	3.07	3.76	3.53	2.84	3.12	3.34	3.84	43.98

DAYS WITH .01 INCH, OR MORE, PRECIPITATION

Beaver Dam	13	9	7	8	9	8	8	8	7	6	5	5	9	89
Earlington	26	9	8	10	10	10	9	8	7	6	5	7	8	97
Leitchfield	21	9	8	10	10	9	9	9	7	7	5	6	9	98
Owensboro	20	9	8	11	10	10	9	8	8	7	6	7	9	102

TABLE 9.
SNOWFALL
(INCHES)

Station	Length of Record Years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Beaver Dam	13	5.3	3.6	1.6	0.3	....	....	....	....	....	T.	0.3	3.3	14.4
Earlington	23	5.6	4.2	1.4	0.3	T.	....	....	....	....	T.	0.2	2.8	14.5
Leitchfield	21	4.2	4.0	1.9	0.5	T.	....	....	....	....	T.	0.3	3.4	14.3
Owensboro	19	3.5	3.3	1.5	0.2	....	....	....	....	....	T.	0.1	2.3	10.9

TABLE 10.

LAND TABLES—1910*

County	Area of County, Acres	Improved Land in Farms, Acres	Per Cent of Land Surface Improved	Woodland in Farms, Acres	Other Unimproved Land in Farms, Acres	Unimproved Land not in Farms, Acres	Total Unimproved Land, Acres	Per Cent of Land Surface Unimproved
Butler	266,880	135,425	50.7	99,497	7,807	24,151	131,455	49.3
Daviess	305,920	227,708	74.4	21,433	17,921	38,858	78,212	25.6
Edmonson	197,120	81,136	41.2	98,607	4,639	12,738	115,984	58.8
Grayson	318,080	192,491	60.5	96,194	6,866	22,529	125,589	39.5
Hancock	123,520	76,062	61.6	17,638	14,888	14,932	47,458	38.4
Henderson	278,400	200,954	72.2	26,497	4,226	46,723	77,446	27.8
Hopkins	349,440	180,955	51.8	89,753	27,555	51,177	168,485	48.2
McLean	161,920	107,473	66.4	31,309	3,834	19,304	54,447	33.6
Muhlenberg	302,080	135,038	44.7	87,819	22,353	56,870	167,042	55.3
Ohio	373,760	225,375	60.3	94,182	18,654	35,549	148,385	39.7
Union	208,000	179,218	86.2	18,976	3,237	6,569	28,782	13.8
Webster	220,160	165,127	75.0	25,891	13,432	15,710	55,033	25.0
Western Coal Field	3,105,280	1,906,962	61.4	707,796	145,412	345,110	1,198,318	38.6
State	25,715,840	14,354,471	55.8	6,951,626	883,030	3,526,713	11,361,369	44.2

*All data, unless otherwise stated, based on U. S. Census.

TABLE 11.

LAND TABLES—1920

County	Area of County, Acres	Improved Land in Farms, Acres	Per Cent of Land Surface Improved	Woodland in Farms, Acres	Other Unimproved Land in Farms, Acres	Unimproved Land not in Farms, Acres	Total Unimproved Land, Acres	Per Cent of Land Surface Unimproved
Butler	266,880	132,770	49.7	88,202	25,044	20,864	134,110	50.3
Daviess	305,920	201,722	65.9	16,298	21,986	65,914	104,198	34.1
Edmonson	197,120	89,821	45.6	69,733	4,206	33,360	107,299	54.4
Grayson	318,080	198,787	62.5	82,909	14,780	21,604	119,293	37.5
Hancock	123,520	63,243	51.2	13,492	26,956	19,829	60,277	48.8
Henderson	278,400	201,360	72.3	22,270	13,111	41,659	77,040	27.7
Hopkins	349,440	191,901	54.9	70,204	30,689	56,646	157,539	45.1
McLean	161,920	106,228	65.6	24,944	11,911	18,837	55,692	34.4
Muhlenberg	302,080	125,647	41.6	69,004	36,969	70,460	176,433	58.4
Ohio	373,760	218,793	58.5	71,544	46,457	36,966	154,967	41.5
Union	208,000	164,968	79.3	13,936	4,603	24,493	43,032	20.7
Webster	220,160	133,241	60.5	18,895	18,685	49,339	86,919	39.5
Western Coal Field	3,105,280	1,828,481	58.9	561,431	255,397	459,971	1,276,799	41.1
State	25,715,840	13,975,746	54.3	6,018,280	1,618,746	4,103,068	11,740,094	45.7

TABLE 12.

GAIN AND LOSS OF IMPROVED FARM LAND FOR THE DECADE 1910-1920

County	Gain in Area of Probably Improved Farm Land by the Clearing of Woodlots	Probably Gross Loss of Cultivable Acreage Largely Due to Erosion	Net Gain of Cultivable Acreage	Net Loss of Cultivable Acreage	Total Remaining Unimproved Acreage
Butler	11,295	13,950		2,655	134,110
Daviess	5,135	31,121		25,986	104,198
Edmonson	28,874	20,189	8,685		107,299
Grayson	13,285	6,989	6,296		119,293
Hancock	4,146	16,965		12,819	60,277
Henderson	4,227	3,821	406		77,040
Hopkins	19,549	8,603	10,946		157,539
McLean	6,365	7,610		1,245	55,692
Muhlenberg	18,815	28,206		9,391	176,433
Ohio	22,638	29,220		6,582	154,967
Union	5,040	19,290		14,250	43,032
Webster	6,996	38,882		31,886	86,919
Western Coal Field	146,365	224,846		78,481	1,276,799
State	933,346	1,312,071		378,725	11,740,094

TABLE 13.

NUMBER OF FARMS—1900-1920

County	Number of Farms.			Increase (+) or Decrease (—) in Number of Farms.	
	1900	1910	1920	1900–1910	1910–1920
Butler	2,223	2,511	2,540	+288	+29
Daviess	3,616	3,707	3,808	+91	+101
Edmonson	1,631	1,892	1,974	+261	+82
Grayson	3,125	3,178	3,362	+53	+184
Hancock	1,332	1,483	1,272	+151	—211
Henderson	2,832	2,734	2,949	—98	+215
Hopkins	2,954	3,292	3,473	+338	+181
McLean	1,570	1,664	1,922	+94	+258
Muhlenberg	2,701	2,851	2,836	+150	—15
Ohio	3,914	4,033	4,112	+119	+79
Union	2,279	1,840	1,809	—439	—31
Webster	2,715	2,459	2,407	—256	—52
Western Coal Field	30,892	31,644	32,464	+752	+820
State	234,667	259,185	270,626	+24,518	+11,441

TABLE 14.

AVERAGE SIZE OF FARMS IN ACRES—1900-1920

County	Average Number Acres Per Farm.		
	1900	1910	1920
Butler	103.9	96.7	96.9
Daviess	78.0	72.0	63.0
Edmonson	91.4	97.5	83.0
Grayson	93.3	93.0	88.2
Hancock	80.3	73.2	81.5
Henderson	91.0	84.7	80.3
Hopkins	94.2	90.6	84.3
McLean	90.2	85.7	74.4
Muhlenberg	92.5	86.0	81.7
Ohio	87.4	83.9	81.9
Union	87.1	109.5	101.4
Webster	72.3	83.1	71.0
Western Coal Field	88.2	87.2	81.4
State	93.6	85.6	79.9

TABLE 15.

IMPROVED LAND IN FARMS—1900-1920

Number of Acres Per Farm.

	Butler	Daviess	Edmonson	Grayson	Hancock	Henderson	Hopkins	McLean	Muhlenberg	Ohio	Union	Webster	Western Coal Field	State
1900	54.9	65.3	48.0	56.2	57.3	76.5	60.6	63.0	51.6	56.0	77.1	53.3	60.3	58.6
1910	53.9	61.4	42.9	60.6	51.3	73.5	55.0	64.6	47.4	55.9	97.4	67.2	60.3	55.4
1920	52.3	53.0	45.5	59.1	49.7	68.3	55.3	55.3	44.3	53.2	91.2	55.4	56.3	51.6

PER CENT OF FARM LAND IMPROVED

	Butler	Daviess	Edmonson	Grayson	Hancock	Henderson	Hopkins	McLean	Muhlenberg	Ohio	Union	Webster	Western Coal Field	State
1900	52.8	83.7	52.4	60.2	71.2	84.1	64.3	69.8	55.8	64.1	88.5	73.7	68.3	62.5
1910	55.8	85.3	44.0	65.1	70.0	86.7	60.7	75.4	55.1	66.6	89.0	80.8	69.1	64.7
1920	54.0	84.0	54.8	67.0	61.0	85.1	65.5	74.2	54.2	65.0	89.9	78.0	69.1	64.7

TABLE 16.

LAND VALUES—ASSESSED VALUES PER ACRE—1900-1920

	Butler	Daviess	Edmonson	Grayson	Hancock	Henderson	Hopkins	McLean	Muhlenberg	Ohio	Union	Webster	Western Coal Field	State
1900	$4.12	$23.97	$3.91	$4.65	$8.61	$25.44	$10.10	$12.18	$6.73	$6.06	$32.34	$16.75	$12.88	$13.24
1910	7.26	41.44	7.35	8.49	14.16	36.08	20.28	22.24	11.72	9.97	43.53	24.28	20.21	21.83
1920	15.84	92.21	14.76	18.61	25.34	79.14	41.87	51.73	23.63	24.28	85.35	52.43	42.81	48.62

PER CENT OF INCREASE IN LAND VALUES BY DECADES—1900-1920

1900 to 1910	76	72	87	82	64	41	100	82	74	64	34	44	56	64
1910 to 1920	118	122	100	119	78	119	106	132	101	143	96	115	111	122

Table 17.

FARM VALUATION AND GROSS INCOME

County	Average Acreage Per Farm.		Average Improved Acreage Per Farm.		Average Assessed Value of all Property Per Farm		Average Gross Crop Return Per Farm.	
	1910	1920	1910	1920	1910	1920	1909	1919
Butler	96.7	96.9	53.9	52.3	$1,376	$2,626	$350.41	$922.02
Daviess	72.0	63.0	61.4	53.0	4.421	8,028	749.65	2,166.81
Edmonson	97.5	83.0	42.9	45.5	1,280	2,144	306.63	806.79
Grayson	93.0	88.2	60.6	59.1	1,579	2,812	396.45	802.64
Hancock	73.2	81.5	51.3	49.7	1,913	3,568	532.52	1,620.01
Henderson	84.7	80.3	73.5	68.3	4,475	8,678	842.07	2,245.35
Hopkins	90.6	84.3	55.0	55.3	2,870	5,065	583.16	1,485.42
McLean	85.7	74.4	64.6	55.3	3,161	5,775	604.45	1,706.39
Muhlenberg	86.0	81.7	47.4	44.3	1,802	3,228	467.81	1,131.55
Ohio	83.9	81.9	55.9	53.2	1,624	3,139	363.56	1,132.23
Union	109.5	101.4	97.4	91.2	6,928	12,003	1,200.03	2,756.05
Webster	83.1	71.0	67.2	55.4	3,119	5,162	555.91	1,764.38
Western Coal Field	87.2	81.4	60.3	56.3	2,817	5,111	565.40	1,512.52
State	85.6	79.9	55.4	51.6	2,986	5,587	536.19	1,288.33

TABLE 18.

CORN PRODUCTION

Number of Bushels of Corn Produced Per Square Mile of Land Surface.

	Butler	Daviess	Edmonson	Grayson	Hancock	Henderson	Hopkins	McLean	Muhlenberg	Ohio	Union	Webster	Western Coal Field	State
1909	1,457.6	3,544.7	1,309.9	1,803.2	2,674.5	4,765.7	1,895.6	2,440.7	1,300.1	1,439.4	7,096.6	2,788.7	2,589.3	2,074.3
1919	1,548.0	2,535.5	1,426.5	1,575.0	2,289.1	3,636.0	1,475.5	2,191.1	1,349.9	1,693.1	4,385.6	2,533.8	2,140.5	1,779.9

Number of Bushels of Corn Produced Per Square Mile of Improved Land.

	Butler	Daviess	Edmonson	Grayson	Hancock	Henderson	Hopkins	McLean	Muhlenberg	Ohio	Union	Webster	Western Coal Field	State
1909	2,872.5	4,763.5	3,184.4	2,980.4	4,344.9	6,604.3	3,661.1	3,677.7	2,909.7	2,387.5	8,237.1	3,718.3	4,216.5	3,716.1
1919	3,112.4	3,846.3	3,131.6	2,520.3	4,471.7	5,027.6	2,687.2	3,341.5	3,245.9	2,892.9	5,531.0	4,188.5	3,635.3	3,275.0

TABLE 19.

WHEAT PRODUCTION

Number of Bushels of Wheat Produced Per Square Mile of Land Surface.

	Butler	Daviess	Edmonson	Grayson	Hancock	Henderson	Hopkins	McLean	Muhlenberg	Ohio	Union	Webster	Western Coal Field	State
1909	30.6	548.1	30.0	160.7	332.5	521.7	115.9	207.8	62.8	97.4	1,368.6	167.5	280.2	217.4
1919	105.3	643.2	61.7	209.9	316.6	494.9	214.1	339.4	184.3	147.8	801.2	237.6	302.8	258.2
Number of Bushels of Wheat Produced Per Square Mile of Improved Land.														
1909	60.3	736.6	72.9	265.7	540.3	722.9	223.8	313.1	140.7	161.6	1,588.5	223.3	456.4	389.6
1919	211.8	975.8	135.6	335.9	618.6	684.3	390.0	517.6	443.1	252.5	1,010.5	392.7	514.3	475.1

TABLE 20.

HAY AND FORAGE PER SQUARE MILE OF LAND SURFACE—1919

County	Total Hay and Forage		All Tame or Cultivated Grasses		Timothy Alone		Timothy and Clover Mixed		Clover Alone		Alfalfa		Other Tame or Cultivated Grasses	
	Acres	Tons	Acres	Tons	Acres	Tons	Acres	Tons	Acres	Tons	Acres	Tons	Acres	Tons
Butler	50.6	42.3	20.7	20.2	2.2	2.1	1.8	1.6	.7	.8	.06	.06	15.7	15.4
Daviess	65.2	81.2	46.3	61.6	9.4	13.0	17.6	22.6	12.2	17.2	1.60	3.44	5.3	5.3
Edmonson	41.4	34.4	8.7	8.9	1.8	1.9	2.0	2.2	1.1	1.2	.06	.04	3.5	3.4
Grayson	74.4	52.8	13.5	12.6	3.9	3.4	1.7	2.0	1.2	2.0	.08	.08	6.5	5.0
Hancock	47.5	51.9	26.7	30.9	6.6	7.6	5.6	7.5	3.9	4.9	1.11	2.61	9.4	8.1
Henderson	38.0	49.2	31.4	38.0	11.5	13.8	10.8	12.7	4.9	5.7	1.61	3.20	2.5	2.5
Hopkins	41.3	41.0	30.9	31.4	5.2	6.6	3.1	4.0	1.5	2.0	.08	.10	20.9	18.6
McLean	57.2	68.6	48.3	55.7	8.6	9.5	20.6	24.3	8.6	10.8	.23	.31	10.1	10.7
Muhlenberg	40.9	38.6	24.1	23.8	5.2	5.1	1.5	2.3	.6	.8	.14	.12	16.4	15.3
Ohio	39.5	40.8	23.9	26.8	5.3	6.0	2.0	2.2	1.8	1.7	.03	.06	14.6	16.7
Union	56.4	99.1	44.0	65.1	11.4	16.7	22.4	35.7	7.1	8.4	1.13	2.28	1.9	1.8
Webster	41.2	53.0	33.9	45.1	4.8	5.5	14.5	17.2	4.4	6.3	....	....	10.1	16.1
Western Coal Field	49.4	53.0	28.7	33.8	6.2	7.4	7.7	10.0	3.7	4.8	.48	.94	10.4	10.5
State	51.8	52.8	22.8	23.6	5.9	6.0	6.3	6.9	2.6	3.0	1.39	2.02	6.4	5.6

TABLE 21.

TOBACCO PRODUCTION

Number Pounds of Tobacco Produced Per Square Mile of Land Surface.

	Butler	Daviess	Edmonson	Grayson	Hancock	Henderson	Hopkins	McLean	Muhlenberg	Ohio	Union	Webster	Western Coal Field	State
1909	4,114.4	34,148.4	1,787.3	4,222.0	21,175.2	23,365.5	13,493.5	19,008.6	5,963.9	9,552.7	10,034.0	21,084.9	13,607.4	9,917.1
1919	4,576.7	36,595.9	5,284.8	3,072.7	16,925.8	23,866.5	19,991.7	25,790.5	10,014.5	13,477.2	13,106.0	23,291.1	16,181.9	12,739.1

Number Pounds of Tobacco Produced Per Square Mile of Improved Land.

1909	8,108.2	45,889.7	4,345.0	6,978.3	34,400.9	32,379.7	26,061.1	28,643.1	13,347.5	15,844.4	11,646.6	28,113.3	22,158.4	17,766.5
1919	9,202.0	55,515.2	11,601.8	4,916.7	33,063.6	33,000.4	36,409.2	39,330.9	24,079.8	23,027.2	16,528.7	38,501.4	27,481.4	23,440.4

TABLE 22.

SUMMARY OF PRODUCTION COSTS OF TOBACCO PER ACRE*

Item	Dark Tobacco District		
	Average	Lowest	Highest
Man hours	262.0	156.4	649.6
Man labor cost	$70.00	$44.90	$159.63
Horse hours	89.0	54.0	179.0
Horse labor cost at 20c	$17.85	$10.80	$35.34
Land rent	25.23	15.00	35.00
Barns and sticks	10.01	6.20	24.81
Machinery	2.76	1.16	13.82
Manure and fertilizer	5.01	.05	40.27
Insurance	6.25	3.79	12.09
"Other" costs:			
Canvas, 5c and 10c per yard	1.01	.58	2.96
Spray material at 50c per pound	1.02	.08	2.71
Coal and wood	2.88	.72	6.87
Plants bought	....	....	....
Seed bought	....	....	....
Miscellaneous	....	....	....
Total cost per acre	$141.75	$100.03	$308.69
Yield per acre, pounds	825	304	1,876
Total cost per pound	$0.172	$0.09	$0.38

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*Nicholls, W. D. and Peck, F. W.—The Cost of Producing Tobacco in Kentucky: Ky. Agr. Exp. Station Bull. No. 229, p. 190.

TABLE 23.

OTHER CROPS, VEGETABLES AND SMALL FRUITS PER SQUARE MILE OF LAND SURFACE—1919

County	Dry Edible Beans		Dry Peas		Potatoes (Irish-White)		Sweet Potatoes and Yams		Other Vegetables	Tobacco		Sorghum Grown for Sirup		Sirup Made	Strawberries		Blackberries and Dewberries	
	Acres	Bus.	Acres	Bus.	Acres	Bus.	Acres	Bus.	Acres	Acres	Lbs.	Acres	Tons	Galls.	Acres	Qts.	Acres	Qts.
Butler	.035	.153	.489	3.160	.53	29.6	.347	25.26	.033	7.1	4,576.7	1.82	5.10	56.1	.023	11.17	.069	67.6
Daviess	.062	.211	.031	.267	.66	37.5	.081	8.50	1.370	37.3	36,595.9	.99	3.85	42.5	.025	25.15	.008	8.2
Edmonson	....	....	.045	.142	.46	27.0	.334	28.75	.025	7.4	5,284.8	1.68	5.05	57.1	.087	97.10	....	.1
Grayson	.004	.060	.046	.241	.42	17.8	.233	10.93	.028	5.3	3,072.7	1.76	5.96	55.8	.010	7.10	.008	4.5
Hancock	.134	.994	.031	.129	.46	18.5	.062	4.82	.569	19.6	16,925.8	2.15	14.70	185.6	.041	21.81	.010	5.7
Henderson	.066	.227	.314	1.156	.46	29.3	.087	6.16	.448	32.9	23,866.5	.43	1.60	15.7	.009	8.75	.002	.8
Hopkins	.014	.060	.146	1.073	.44	28.6	.282	23.84	.547	24.7	19,991.7	.84	2.28	32.5	.031	22.58	.056	46.2
McLean	.059	.118	.110	1.007	.23	11.6	.059	4.35	.699	31.2	25,790.5	.78	2.61	33.4	.015	13.28	.003	3.1
Muhlenberg	.010	.127	.216	2.203	.53	30.1	.370	30.05	.269	13.5	10,014.5	1.25	3.26	49.9	.057	31.06	.042	43.5
Ohio	.063	.363	.301	.333	.58	27.6	.376	16.48	.039	17.6	13,477.2	1.43	4.35	63.6	.029	15.79	.113	61.0
Union	.003	.030	.089	.486	.39	24.1	.033	3.61	.024	17.0	13,106.0	.18	.64	9.0	.015	12.30	.003	.9
Webster	....	.008	.142	.595	.17	10.0	.142	12.34	.090	31.3	23,291.1	.74	1.54	24.3	.011	11.66	.084	60.3
Western Coal Field	.034	.171	.177	.943	.46	25.5	.221	15.63	.342	20.2	16,181.9	1.16	3.86	47.4	.028	21.79	.038	28.7
State	.189	1.073	.096	.566	1.24	77.9	.370	30.42	.401	15.9	12,739.1	1.24	3.85	50.8	.077	79.50	.060	44.2

TABLE 24.

ORCHARD FRUITS AND GRAPES PER SQUARE MILE OF LAND SURFACE—1919

County	Apples			Peaches			Pears			Plums & Prunes			Cherries			Grapes		
	Trees not of Bearing Age	Trees of Bearing Age	Bushels Harvested	Trees not of Bearing Age	Trees of Bearing Age	Bushels Harvested	Trees not of Bearing Age	Trees of Bearing Age	Bushels Harvested	Trees not of Bearing Age	Trees of Bearing Age	Bushels Harvested	Trees not of Bearing Age	Trees of Bearing Age	Bushels Harvested	Vines not of Bearing Age	Vines of Bearing Age	Pounds Harvested
Butler	25.2	73.3	34.5	19.3	59.0	33.76	1.2	4.0	2.15	5.9	23.5	4.32	1.3	3.7	.78	.6	2.9	13.8
Daviess	33.3	73.7	65.5	10.8	12.7	7.94	1.3	3.5	5.38	1.1	5.7	4.96	2.4	4.5	2.20	2.1	22.4	157.9
Edmonson	35.6	69.5	26.6	18.9	55.5	28.98	1.4	1.9	.61	1.6	6.0	1.09	1.1	2.1	.30	.3	1.5	9.3
Grayson	35.3	128.9	27.2	19.0	53.7	22.22	1.6	4.6	1.72	1.3	6.7	1.55	2.5	4.3	.61	1.1	6.9	43.8
Hancock	25.6	126.6	57.4	8.8	33.6	13.91	1.4	3.7	2.52	.9	12.5	5.27	1.3	4.6	1.55	1.7	12.3	126.5
Henderson	69.0	170.4	229.1	17.3	13.8	9.09	1.4	6.9	7.75	.4	3.8	3.22	1.8	4.6	2.37	2.4	9.8	13.6
Hopkins	34.1	94.0	82.4	16.8	26.9	15.47	1.6	3.6	3.81	1.1	4.1	2.42	2.5	5.5	1.82	1.3	5.0	43.3
McLean	34.8	82.3	60.4	15.0	18.2	13.60	1.5	3.7	3.07	1.0	8.2	5.18	2.9	5.0	2.86	.6	6.1	43.0
Muhlenberg	35.2	66.5	45.9	19.5	40.8	20.91	2.2	4.3	1.88	1.2	6.2	1.83	3.4	4.9	1.38	1.5	4.4	48.0
Ohio	32.7	81.2	29.3	15.2	44.3	18.10	1.7	4.0	2.07	.8	8.2	1.86	2.6	4.6	.82	1.1	7.9	38.9
Union	26.8	32.7	40.1	11.4	12.6	7.85	1.2	1.1	1.48	.4	1.4	.90	1.5	2.2	1.40	2.0	1.6	21.6
Webster	30.2	82.2	74.4	14.8	20.6	13.17	1.1	4.1	4.20	.6	4.4	1.77	.7	6.3	2.29	.2	2.2	32.2
Western Coal Field	35.5	90.6	65.1	16.0	33.5	17.29	1.5	3.9	3.14	1.4	7.4	2.72	2.1	4.4	1.48	1.3	7.2	48.3
State	35.5	93.1	31.8	17.1	41.5	11.44	1.9	5.9	1.36	1.4	7.0	1.70	1.8	4.2	.67	1.7	8.1	37.2

TABLE 25.

POULTRY AND EGGS PRODUCED PER SQUARE MILE OF LAND SURFACE

County	Number of Poultry		Dozens of Eggs Produced		Dozens of Eggs Sold	
	1910	1920	1909	1919	1909	1919
Butler	207.0	290.5	1,049.6	1,276.2	818.1	1,017.0
Daviess	291.2	331.0	1,311.7	916.7	647.7	456.6
Edmonson	157.6	215.0	662.8	1,015.8	457.3	706.2
Grayson	249.3	352.9	1,295.7	1,789.1	1,001.8	1,141.6
Hancock	262.7	290.8	1,409.0	958.1	904.2	656.6
Henderson	234.4	250.2	946.5	985.8	435.5	401.3
Hopkins	162.9	190.4	754.8	644.5	353.9	304.8
McLean	232.4	327.2	1,065.2	950.0	566.2	636.9
Muhlenberg	150.7	209.2	673.1	795.2	355.7	459.1
Ohio	198.2	297.7	948.9	1,266.5	613.3	887.4
Union	236.1	236.1	1,069.6	1,095.2	510.5	524.3
Webster	203.6	212.8	674.5	875.7	326.3	383.1
Western Coal Field	212.7	266.9	974.8	1,061.5	575.9	637.5
State	218.1	274.2	1,007.0	1,009.8	615.8	637.9

TABLE 26.

BEES, HONEY AND WAX PRODUCED PER SQUARE MILE OF LAND SURFACE

County	Number of Hives of Bees		Pounds of Honey Produced		Pounds of Wax Produced	
	1910	1920	1909	1919	1909	1919
Butler	.8	2.5	5.6	12.1	.16	.23
Daviess	2.7	2.3	14.0	15.9	.32	.17
Edmonson	.9	2.3	12.2	25.2	.54	.66
Grayson	1.0	2.6	7.8	14.1	.15	.14
Hancock	2.3	2.3	7.3	16.4	.10	.06
Henderson	2.1	1.9	22.9	15.4	.25	.18
Hopkins	2.6	3.5	22.1	28.4	.26	.11
McLean	4.5	3.4	27.5	14.6	.08	.02
Muhlenberg	1.9	3.0	14.6	16.5	.19	.15
Ohio	1.9	3.0	9.2	17.3	.13	.15
Union	2.4	1.0	24.2	7.5	.20	.03
Webster	2.2	1.9	12.5	8.4	.04	.07
Western Coal Field	2.0	2.6	14.7	16.4	.21	.17
State	3.8	3.9	38.7	39.9	.43	.38

TABLE 27.

DAIRY PRODUCTS PER SQUARE MILE OF LAND SURFACE

County	Milk Produced, Gallons		Milk Sold, Gallons		Cream Sold, Gallons		Butter Fat Sold, Pounds		Butter Produced, Pounds		Butter Sold, Pounds		Cheese Produced, Pounds	
	1909	1919	1909	1919	1909	1919	1909	1919	1909	1919	1909	1919	1909	1919
Butler	2,341.1	2,336.5	15.5	29.3	....	....	....	2.0	816.8	847.5	35.1	40.1	.107	....
Daviess	3,945.1	3,168.8	327.4	440.1	1.82	17.39	....	35.8	1,262.1	1,048.8	478.4	352.9	3.974	.07
Edmonson	2,586.5	2.711.4	16.4	23.4	....	....	....	2.1	840.0	966.7	73.4	130.5	....	....
Grayson	2,733.1	2,532.1	82.9	40.6	2.31	....	....	5.5	875.3	1,030.4	110.7	121.2	....	.04
Hancock	3,723.1	2,991.7	41.3	118.7	.03	45.75	....	68.8	1,203.4	923.7	293.9	167.9	....	....
Henderson	2,753.1	2,891.0	187.4	287.9	2.93	22.06	....	21.4	925.5	901.2	324.2	282.0	....	....
Hopkins	2,935.2	2,521.8	152.3	263.8	.49	.78	....	5.5	1,077.2	935.1	259.4	264.0	....	....
McLean	3,177.4	3,545.4	49.2	64.8	....	.70	....	25.5	993.3	1,035.3	259.9	252.8	....	.03
Muhlenberg	2,717.8	2,415.2	112.5	185.9	....	.24	....	5.8	977.3	962.7	178.0	183.1	....	.33
Ohio	3,065.8	2,919.3	31.7	40.2	....	7.34	....	10.3	980.4	1,020.4	163.8	162.8	....	....
Union	2,364.7	2,897.9	69.3	166.1	.03	5.63	....	3.8	660.4	491.4	180.7	138.7	....	....
Webster	2,773.5	2,056.5	76.2	144.1	....	3.24	....	6.2	802.4	695.6	168.9	179.6	....	....
Western Coal Field	2,913.3	2,717.5	106.1	159.4	.73	7.15	....	13.5	955.6	918.5	210.8	193.2	.400	.04
State	3,125.0	3,272.5	259.2	310.3	3.95	39.30	3.8	105.4	948.9	848.1	209.5	147.2	1.397	.33

Table 28.

SHEEP SHORN AND WOOL PRODUCED PER SQUARE MILE OF LAND SURFACE—1909-1919

County	Number of Sheep Shorn		Wool Produced, Pounds
	1909	1919	1919
Butler	9.6	7.6	35.3
Daviess	6.2	2.9	18.4
Edmonson	8.3	7.2	33.2
Grayson	16.8	13.8	68.0
Hancock	9.8	4.6	25.9
Henderson	4.5	5.5	37.2
Hopkins	5.8	6.3	32.2
McLean	8.7	4.0	22.9
Muhlenberg	7.3	5.3	27.4
Ohio	10.0	5.4	31.0
Union	5.5	4.0	33.0
Webster	5.0	5.7	35.4
Western Coal Field	8.2	6.2	34.2
State	15.6	13.6	63.9

TABLE 29.
FORMATION OF THE WESTERN COAL FIELD COUNTIES*

County	Area in Square Miles	Date of Formation	Counties from which Formed	Named for	County Seat
Henderson	435	1798	Christian	Col. Richard Henderson	Henderson
Muhlenberg	472	1798	Logan, Christian	Gen. Peter Muhlenberg	Greenville
Ohio	584	1798	Hardin	Ohio River	Hartford
Hopkins	546	1806	Henderson	Gen. Samuel Hopkins	Madisonville
Butler	417	1810	Logan, Ohio	Gen. Butler	Morgantown
Grayson	497	1810	Ohio, Hardin	Col. Wm. Grayson	Leitchfield
Union	325	1811	Henderson	In recognition of spirit of people	Morganfield
Daviess	478	1815	Ohio	Joseph Hamilton Daviess	Owensboro
Edmonson	308	1825	Grayson, Hart, Warren	Capt. John Edmonson	Brownsville
Hancock	193	1829	Breckinridge, Daviess, Ohio	John Hancock	Hawesville
McLean	253	1854	Daviess, Muhlenberg, Ohio	Judge Alney McLean	Calhoun
Webster	344	1860	Henderson, Hopkins, Union	Daniel Webster	Dixon

*Collins, Richard H. History of Kentucky, Vol. II, p. 26; U. S. Census.

TABLE 30.

ILLITERACY—TEN YEARS OF AGE AND OVER

County	Total Illiterate				Native White				Foreign-Born White				Negro			
	Number Illiterate		Per Cent Illiterate		Number Illiterate		Per Cent Illiterate		Number Illiterate		Per Cent Illiterate		Number Illiterate		Per Cent Illiterate	
	1910	1920	1910	1920	1910	1920	1910	1920	1910	1920	1910	1920	1910	1920	1910	1920
Butler	1,854	1,179	16.2	10.6	1,744	1,126	15.9	10.5	2	......	......	......	108	53	25.5	14.6
Daviess	2,490	1,928	7.9	6.0	1,439	1,119	5.3	4.0	22	14	5.8	6.0	1,029	795	24.3	21.1
Edmonson	1,351	870	18.9	11.4	1,283	825	18.8	11.2	......	......	......	......	68	45	22.4	16.7
Grayson	1,774	1,350	12.4	9.2	1,702	1,309	12.2	9.1	1	3	......	......	71	38	27.8	18.9
Hancock	706	363	11.0	6.8	558	301	9.4	5.9	6	4	......	......	142	58	31.8	20.6
Henderson	2,373	1,626	10.5	7.5	860	711	5.1	4.2	24	21	6.6	8.3	1,489	894	27.8	19.4
Hopkins	3,452	2,764	13.2	10.4	2,116	1,827	10.1	8.4	16	3	13.8	......	1,320	934	25.5	19.1
McLean	978	499	10.0	5.3	785	413	8.6	4.6	4	3	......	......	189	83	33.6	18.5
Muhlenberg	3,103	2,622	14.8	10.8	2,487	2,199	13.4	10.0	36	15	19.4	12.4	580	407	26.2	18.8
Ohio	2,003	1,349	9.8	6.8	1,708	1,190	8.8	6.2	7	1	......	......	288	158	28.5	22.8
Union	1,256	987	8.4	7.3	739	498	5.8	4.2	9	1	8.0	......	508	488	26.5	28.3
Webster	1,364	1,176	8.8	7.3	920	757	6.8	5.6	10	5	......	......	434	414	20.8	17.6
Western Coal Field	22,704	16,713	11.2	8.2	16,341	12,275	9.2	6.8	137	70	9.4	7.8	6,226	4,367	25.9	20.0
State	208,084	155,014	12.1	8.4	146,797	112,206	10.0	7.0	3,300	2,244	8.3	7.3	57,900	40,548	27.6	21.0

TABLE 31.

MORTALITY STATISTICS*

Average Death Rates Per 100,000 Population for 10 Years (1911-1921).
Western Coal Field.

County	Tuberculosis	Pneumonia	Diptheria	Typhoid	Cancer
Butler	186.1	62.0	9.5	25.0	25.1
Daviess	202.2	109.5	15.1	37.4	55.5
Edmonson	139.5	83.8	19.6	42.0	32.8
Grayson	193.6	107.5	28.0	45.5	29.5
Hancock	185.8	70.5	9.4	35.1	35.8
Henderson	211.6	128.7	18.1	39.5	45.0
Hopkins	204.1	104.5	11.8	48.1	48.8
McLean	206.5	122.6	15.3	35.7	33.5
Muhlenberg	197.3	108.8	22.9	38.8	34.0
Ohio	150.1	119.7	27.3	38.8	28.6
Union	172.5	82.0	22.2	32.6	40.9
Webster	177.8	111.0	14.1	54.0	27.4

*Data from J. F. Blackerby, Registrar, State Board of Health.

TABLE 32.

MORTALITY STATISTICS*

Comparison of State and Physiographic Divisions
Average Death Rates Per 100,000 Population for 10 Years (1911-1921).

Divisions	Tuber-culosis	Pneu-monia	Diptheria	Typhoid	Cancer
State of Kentucky	180.1	124.2	16.2	29.3	49.5
Blue Grass	201.8	129.2	15.1	28.7	62.4
Knobs	167.7	103.3	21.6	32.1	40.8
Mountains	106.9	89.2	21.5	30.9	20.9
Western Coal Field	183.9	100.8	17.7	39.4	36.4
Jackson Purchase	197.0	133.0	19.1	33.4	37.8
Southern and Southwestern Carboniferous Plateau	233.1	104.2	17.8	39.5	47.9

*Data from J. F. Blackerby, Registrar, State Board of Health.

TABLE 33.

TENANTS

County	Number of Farms Worked by Tenants			Per Cent of All Farms Worked by Tenants	Assessed Value of Land Per Acre
	1900	1910	1920	1920	1920
Butler	547	670	521	20.5	$15.84
Daviess	1,363	1,417	1,708	44.9	92.21
Edmonson	382	502	542	27.5	14.76
Grayson	791	691	646	19.2	18.61
Hancock	461	574	412	32.4	25.34
Henderson	1,462	1,468	1,495	50.7	79.14
Hopkins	1,101	1,381	1,369	39.4	41.87
McLean	521	592	734	38.2	51.73
Muhlenberg	826	872	711	25.1	23.63
Ohio	989	967	833	20.3	24.28
Union	1,107	796	893	49.4	85.35
Webster	1,277	1,072	1,005	41.8	52.43
Western Coal Field	10,827	11,002	10,869	33.4	42.81
State	77,065	87,860	90,330	33.4	48.62

Table 34.

COLOR AND NATIVITY OF FARMERS

County	Color and Nativity of All Farmers						Color and Nativity of Owners Operating Farms						Color and Nativity of Tenants					
	Native White		Foreign-born White		Negro and Other Non-white		Native White		Foreign-born White		Negro and Other Non-white		Native White		Foreign-born White		Negro and Other Non-white	
	1910	1920	1910	1920	1910	1920	1910	1920	1910	1920	1910	1920	1910	1920	1910	1920	1910	1920
Butler	2,454	2,486	1	1	56	53	1,802	1,973	1	1	34	40	649	509	......	......	21	12
Daviess	3,415	3,464	36	16	256	328	2,132	1,963	31	14	103	102	1,261	1,480	4	2	152	226
Edmonson	1,823	1,922	5	4	64	48	1,332	1,397	4	......	53	34	490	525	1	4	11	13
Grayson	3,153	3,340	11	3	14	19	2,447	2,687	11	3	11	19	688	646	......	......	3	......
Hancock	1,425	1,252	13	3	45	17	881	852	12	3	14	2	542	397	1	......	31	......
Henderson	2,238	2,489	27	20	469	440	1,096	1,297	19	16	127	109	1,119	1,163	7	4	342	328
Hopkins	3,140	3,372	2	4	150	97	1,850	2,049	1	4	49	39	1,280	1,312	1	......	100	57
McLean	1,613	1,867	5	1	46	54	1,049	1,162	4	1	17	18	562	699	1	......	29	35
Muhlenberg	2,728	2,752	11	3	112	81	1,887	2,051	10	2	71	59	830	689	1	1	41	21
Ohio	3,961	4,065	9	2	63	45	3,010	3,230	8	2	42	33	945	821	1	......	21	12
Union	1,746	1,696	7	5	87	108	998	877	7	4	33	21	742	805	......	1	54	87
Webster	2,333	2,255	3	1	123	151	1,331	1,347	3	1	50	47	999	901	......	......	73	104
Western Coal Field	30,029	30,960	130	63	1,485	1,441	19,815	20,885	111	51	604	523	10,107	9,947	17	12	878	895
State	245,499	256,886	1,956	1,112	11,730	12,628	162,736	173,070	1,667	938	5,929	5,319	81,837	82,898	262	158	5,761	7,274

TABLE 35.

RAILROADS*

County	Illinois Central	Louisville & Nashville	Louisville, Henderson & St. Louis	Mammoth Cave	Kentucky Midland	Total Milage	Sq. Mi. of Area Per Mile of R. R.
						None	
Butler						59.74	8.00
Daviess	18.99	14.45	26.30			11.13	27.67
Edmonson		4.39		6.74		33.80	14.70
Grayson	33.80					24.10	8.00
Hancock			24.10			51.92	8.37
Henderson	20.00	14.92	17.00			99.46	5.48
Hopkins	22.26	77.20				11.36	22.27
McLean		11.36				75.24	6.27
Muhlenberg	26.05	40.08			9.11	83.99	6.95
Ohio	47.64	30.65	5.70			55.87	5.81
Union	42.66	13.21				55.68	6.17
Webster	29.88	25.80					
Western Coal Field	241.28	232.06	73.10	6.74	9.11	562.29	8.62

*21st Biennial Report Bureau of Agriculture, Labor and Statistics. Corrected to 1923.

TABLE 36.

COAL PRODUCTION BY DISTRICTS FOR 1922*

Districts	Tons	Mines	Men Outside	Men Inside	Total Men Employed	Days Worked	Elec. Mines	Pick Mines	Wagon Mines	Tons for Wagon Mines	Mines Not Co-operating	Tons of Non-Co-op.
No. 1	7,466,915	89	1,193	7,726	8,919	151	57	32	18	18,000	4	88,760
No. 2	5,904,035	71	1,018	7,081	8,099	152	41	30	15	15,000	....	....
Total	13,370,950	160	2,211	14,807	17,018	303	98	62	33	33,000	4	88,760

COAL PRODUCTION FOR FIRST SIX MONTHS OF 1923**

First District

Counties	Tons	Men Outside	Men Inside	Days Worked
Webster	576,777	252	1,738	46
Hopkins	967,819	535	2,845	35
Christian	43,397	28	205	31
Henderson	172,307	78	617	54½
Union	1,071,529	151	1,252	80
Totals	2,822,829	1,044	6,658	Av. 49.26
Second District				
Daviess	66,103	33	135	117
McLean	39,890	36	231	29
Ohio	397,949	260	1,163	38
Muhlenberg	1,607,348	660	4,990	54
Hancock has not any mines co-operating.				
Totals	2,111,290	989	6,519	Av. 59½

*Blenkinsopp, L. Report of Department of Mines, Kentucky, Part I, p. 10, 1922.
**Blenkinsopp, L. Semi-Annual Report for First Six Months of 1923.

TABLE 37.

MANUFACTURES

City	Census for the Year	Number of Establishments	Average Number of Wage Earners	Value of Products
Henderson	1919	31	967	$4,765,359
	1914	42	1,147	2,973,457
Owensboro	1919	64	1,380	8,634,737
	1914	62	1,001	4,056,142

TABLE 38.

POPULATION PER SQUARE MILE OF LAND SURFACE—1900-1920

County	Total Population			Rural Population		
	1900	1910	1920	1900	1910	1920
Butler	38.1	37.9	36.4	38.1	37.9	36.4
Daviess	80.8	85.8	85.2	53.3	52.3	48.7
Edmonson	32.7	34.0	35.3	32.7	34.0	35.3
Grayson	39.9	40.2	40.0	39.9	40.2	40.0
Hancock	46.1	44.1	35.9	46.1	44.1	35.9
Henderson	75.6	67.5	63.4	52.0	41.1	35.4
Hopkins	56.7	62.8	62.5	44.6	46.5	46.6
McLean	49.2	52.3	49.4	49.2	52.3	49.4
Muhlenberg	43.9	60.6	70.6	43.9	55.2	64.0
Ohio	46.7	47.3	45.3	46.7	47.3	45.3
Union	65.6	61.2	55.5	65.6	52.8	47.3
Webster	58.4	61.0	60.3	58.4	61.0	48.2
Western Coal Field	53.4	55.5	54.9	47.2	47.0	45.0
State	53.4	57.0	60.1	41.7	43.2	44.3

TABLE 39.

POPULATION—1910-1920

County	Native White				Foreign-born White				Negro			
	Number		Per Cent		Number		Per Cent		Number		Per Cent	
	1910	1920	1910	1920	1910	1920	1910	1920	1910	1920	1910	1920
Butler	15,235	14,720	96.4	96.9	9	2	0.1	(*)	561	475	3.5	3.1
Daviess	35,443	35,964	86.4	88.3	381	236	0.9	0.6	5,195	4,533	12.7	11.1
Edmonson	10,017	10,524	95.7	96.6	13	10	0.1	0.1	439	360	4.2	3.3
Grayson	19,592	19,663	98.2	98.7	33	20	0.2	0.1	333	244	1.7	1.2
Hancock	7,877	6,550	92.5	94.3	69	27	0.8	0.4	566	368	6.6	5.3
Henderson	22,166	21,659	75.5	78.4	368	257	1.3	0.9	6,818	5,693	23.2	20.6
Hopkins	27,602	28,031	80.5	82.1	116	65	0.3	0.2	6,573	6,037	19.2	17.7
McLean	12,458	11,881	94.1	95.0	33	19	0.2	0.2	750	602	5.7	4.8
Muhlenberg	25,499	30,457	89.2	91.3	188	123	0.7	0.4	2,911	2,758	10.2	8.3
Ohio	26,262	25,558	95.0	96.5	92	30	0.3	0.1	1,288	885	4.7	3.3
Union	17,360	15,784	87.3	87.5	112	63	0.6	0.3	2,414	2,193	12.1	12.2
Webster	18,289	17,793	87.2	85.7	42	46	0.2	0.2	2,643	2,922	12.6	14.1
Western Coal Field	237,800	238,584	88.2	89.5	1,456	898	0.5	0.3	30,491	27,070	11.3	10.2
State	1,987,898	2,149,780	86.8	89.0	40,053	30,780	1.7	1.3	261,656	235,938	11.4	9.8

*Less than one-tenth of 1 per cent.

TABLE 40.

WEALTH—1920*

County	Total Taxable Wealth	Taxable Wealth Per Square Mile of Area	Taxable Wealth Per Capita
Butler	$4,929,437	$11,821	$324.36
Daviess	38,164,204	79,841	936.93
Edmonson	3,875,461	12,582	355.74
Grayson	7,367,948	14,824	369.74
Hancock	3,546,902	18,377	510.71
Henderson	28,432,992	65,363	1,029.84
Hopkins	15,205,514	27,848	445.47
McLean	8,146,937	32,201	651.65
Muhlenberg	10,245,720	21,707	307.19
Ohio	10,856,057	18,589	410.08
Union	20,382,242	62,714	1,129.83
Webster	10,363,575	30,126	499.16
Western Coal Field	161,516,989	33,288	605.91
State	2,438,612,499	60,690	1,009.09

*Data based on Fifth Biennial Report, Department of State Roads and Highways.

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